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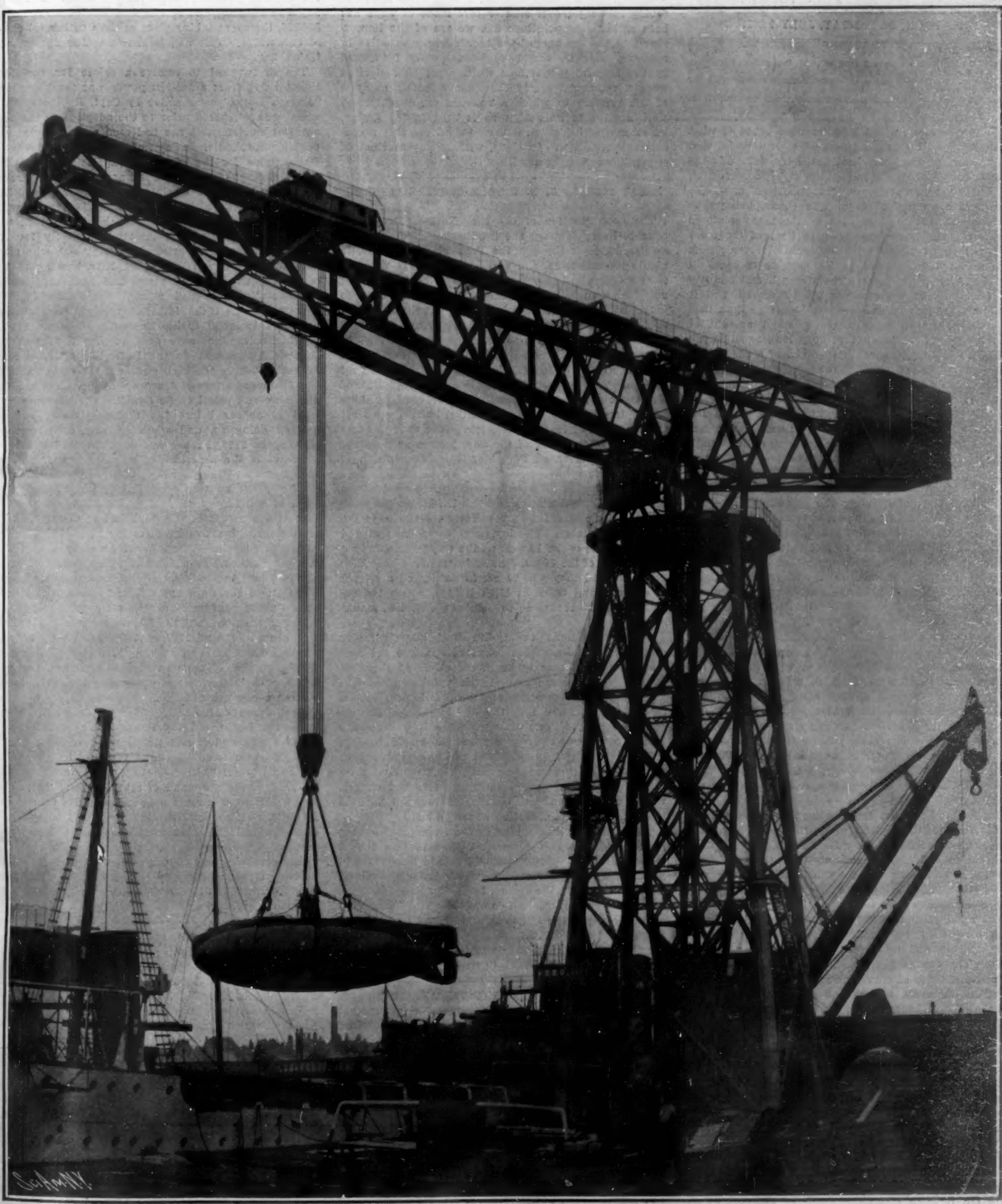

LIFTING A BRITISH SUBMARINE BOAT WITH A 150-TON ELECTRIC CRANE.—[See page 67.]

Total Height from Water-level, 180 Feet; Total Radius, 150 Feet.

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, JULY 28, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

ENGLISH CARS IN RAILROAD WRECKS.

The photographs which have been published of what was left of the London and South-Western special boat train after the fatal wreck at Salisbury, furnish additional proof of the exceedingly light construction of English passenger cars. To American eyes, the frailty of construction revealed in these photographs is truly astonishing. Not one of the many pictures which are published from time to time of the more serious railroad disasters in this country, reveals such a complete disintegration of the cars as occurred in this Salisbury derailment. The strength and security of the American Pullman car are proverbial, and it will pass through ordeals even more severe than that at Salisbury, with a surprisingly small amount of injury. Indeed, it was not so very long ago that we published in this journal photographs of a car which, after leaving the rails, rolled completely over down an embankment and landed right-side up with no structural injury that was not quickly repairable.

Undoubtedly, the great strength and weight of the American car and the relative lightness and weakness of the English car are the outcome of the conditions under which the railroad systems of the two countries have been developed. The vast distances to be covered in America; the impossibility, because of the prohibitive cost, of building the pioneer railroads of first-class construction; the poor character of the signal system; and the consequent frequency and serious nature of the derailments and collisions, rendered it necessary, early in the development of our railroads, to build the rolling stock of great strength and weight. Moreover, the adoption of the swiveling truck placed at each end of the car, as distinguished from the rigid axles distributed along the length of the car in the English and Continental system, made it possible in America to construct the cars of much greater length than was possible in Europe; and with the increase in length, it became necessary to make a proportionately greater increase in the strength. These two causes combined are answerable for the weight and strength of the American passenger car of to-day, and the development has been pushed to such a length, that the latest passenger Pullman cars weigh between sixty and seventy tons apiece, which is more than the weight of many of the passenger locomotives of the present day.

In England and on the Continent, development of the railroads took place after the population had grown to a density which guaranteed a heavy freight and passenger traffic immediately upon the opening of the roads, and warranted the construction of the roadbed, track, and bridges, upon a scale of solidity and excellence which was impossible in building the pioneer railroads of America. Not only so, but early in their history, an excellent system of safety signals was adopted, and travel was thus rendered relatively safe. The excellent roadbed, heavy track, and comparative absence of curvature made it possible for the English engineers to use the rigid axle and short length of car; hence it was not necessary to build the cars on such massive lines as here in America. English rolling stock has always appeared to be remarkably light as compared with the rolling stock in America. Thus, in the largest Pullman cars, between 2¼ and 2½ tons of dead weight must be hauled for each passenger carried; whereas in the heaviest English cars, the proportion will be only from 1¼ to 1½ tons to the passenger; and in the majority of the rolling stock, which is of the older rigid-axle type, the dead weight will work out at from one-third to one-half of a ton per passenger. When English railroad officials have been charged with building their cars too light to stand the shock of collision or derailment, they have retorted that their rolling stock is not designed for collision, but for normal operation on properly built and operated roads, and that the number of accidents is so exceedingly small that they would not be warranted in allowing the very limited risk of such accidents to impose an unnecessary burden of weight upon the cars. They furthermore reply in answer to our criticism, that it would be better for us to decrease somewhat the weight of our rolling stock, which is not only costly to build, but exceedingly costly in the wear which it causes upon track, bridges, etc., and invest the money so saved in extending our block signal service until it embraces the whole of our railroad system.

We are inclined to think that the best type of car with respect to weight and strength lies somewhere between the over-light English car and the over-heavy American Pullman; and we are satisfied that the solution of the problem will be found in the adoption of the all-steel system of construction. Up to the present time, in the steel cars which have been built for various railroads and different classes of service, the saving in weight over similar cars made of wood has been rather disappointing; but we are of the impression that the designers have been over-conservative in reducing weights, and have been unduly influenced by the massive proportions which have characterized wooden construction. If the same scientific analysis of the stresses to which a railroad car is subjected were applied to its design as is used in the design, let us say, of bridge structures, we believe that a considerable reduction of weight, without any sacrifice of strength, would be secured.

EARLY OPENING OF NEW YORK CENTRAL ELECTRIC SERVICE.

The determination of the New York Central Company to hurry forward the installation of the electric service, at least through the Park Avenue tunnel, is highly commendable, and will be exceedingly welcome to everyone who has occasion to travel by way of that notorious two miles of discomfort. If one were to judge by the apparently backward condition of the new terminal itself, it would look as though the opening of the new electric service were yet many years removed; but the company has wisely determined not to wait upon the completion of the Grand Central Station. They propose to complete the excavation of the easterly half of the station yard; create a temporary terminal at the Grand Central Palace, and start the operation of trains by electric power over the first few miles of road out of the city, just as soon as the new power station at Port Morris is in condition to supply the current.

The time set for the opening of electrical service from the Grand Central Station to High Bridge on the main line, and to Wakefield on the Harlem division, is the middle of October. The laying of the third rail and placing of the cables is well on the way to completion; already two of the 85-ton electric locomotives have been delivered, and they will be set in service on a stretch of experimental track at High Bridge, where the engineers will be broken in to their new duties as motormen.

One hundred and twenty-five steel electric motor cars and 55 trailers have been ordered, and the first installment will shortly be in the city. At the Port Morris power house, one of the turbine generators has been put in operation, and another is nearly completed. By October 15th the divisions from Harlem and Wakefield to Forty-second Street will be in condition to commence active operation, and as the months pass by, the electrical equipment will be extended, both as regards the line and the rolling stock, without waiting for the completion of the great terminal station, whose construction can be carried forward without interference in the operation of the trains.

The equipment of the New Haven system is also being pushed vigorously; the concrete piers for the towers which will carry the overhead line are nearly all in place, and the power station, which is being built at Cos Cob to supply the system from Woodlawn to Stamford, is now about one-half completed. The New Haven electric locomotives will use the overhead system from Stamford to Woodlawn, from which point into the Grand Central Station they will take current from the third rail of the New York Central system.

THE FIRST FOREIGN SALUTE OF THE AMERICAN FLAG.

The question raised by a correspondent on another page of this issue as to when and where the American flag was first saluted by a foreign government, is one which has been the subject of considerable controversy; although the actual facts of the case are, and for some time have been, well known to careful students of American history. It is popularly supposed that the first salute was given to the American warship "Ranger" when she was under command of Paul Jones, and that the event occurred in 1778. On the other hand, it has long been known to students of history that two years earlier a salute was given to the American flag by the governor of one of the Dutch West India islands. The confusion has arisen from the fact that prior to the adoption of the stars and stripes as the national emblem, the colonies had adopted another flag in which the stars did not appear. It was the earlier flag which was saluted in 1776; while Paul Jones is quite correct in stating that the first foreign salute to the stars and stripes was given to the little war vessel "Ranger" while she was under his own command.

The necessity for the adoption of a common national flag does not seem to have impressed itself upon the American colonies until toward the close of the year 1775, when a committee consisting of Dr. Franklin, Mr. Lynch, and Mr. Harrison was appointed to consider this subject. They met at the camp of the Colonials at Cambridge, and proposed the adoption of a flag which should retain in the corner the King's colors or Union Jack, consisting of the combined crosses of St. Andrew and St. George, thereby representing the still recognized sovereignty of England; but that the field of the flag should consist of thirteen stripes alternate red and white, which should be emblematic of the union of the thirteen colonies against the tyranny and oppression of the King. The new flag was adopted, and it was first hoisted on January 2, 1776, the event taking place at the Continental camp at Cambridge. This flag is known as the Continental Union flag.

The first vessel to receive a salute for the Continental flag from a foreign power was the little brig "Andrea Doria," commanded by Capt. Robinson. This vessel was purchased prior to the adoption of the new national emblem, and she had seen active service under Nicholas Biddle. In September, 1776, she sailed from Philadelphia for the island of St. Eustatius, to take aboard a cargo of arms. On her arrival at that port on November 16, 1776, she saluted the Dutch flag, and her salute was returned by the governor, De Graaff, with thirteen guns, corresponding to the thirteen States. The gallant governor bid fair to pay dearly for his enthusiasm; for Mr. Christopher Greathead, who commanded the British island of St. Kits, hearing that a certain North American vessel had been supplied at St. Eustatius and had saluted the Dutch fort of Orange, and that the fort had replied, remonstrated against this insult to his Britannic Majesty. Proofs of this salutation were sent to Sir Knight York, English Ambassador to the Dutch Republic, and he laid them before the high and mighty States General, and demanded a formal disavowal of the salute and the discharge and recall of De Graaff. The governor was cited to appear before the States General; but he delayed doing so, and when he eventually reached Holland in 1778, France had acknowledged the independence of the American colonies, and other nations soon followed. The offense of De Graaff was no longer a solitary one, and the complaint against him was lost sight of and forgotten.

In 1776 a pamphlet was published in Concord, N. H., entitled "The Stars and Stripes the Flag of the United States of America—When, Where, and by Whom was it First Saluted," in which the writer proves the fact of the salute in the West Indies, and speaks of it as a "salute of the stars and stripes." This, as we have shown above, was an error, the stars not having been added to the flag until the following year.

It was on June 14, 1777, that the American Congress resolved that the flag of the thirteen united States should consist of thirteen stripes alternate red and white, with thirteen stars, white in a blue field, representing a new constellation.

Paul Jones claimed that it was his good fortune to be the first to display the stars and stripes on a naval vessel, and it had previously been his to hoist with his own hand the "flag of America" on board the naval vessel "Alfred." He was appointed on June 14, 1777, to the command of the "Ranger," which carried a battery of sixteen six-pounders. He crossed the Atlantic, and on entering Quiberon Bay, on the 14th of February, 1778, he saluted the French fleet under Admiral La Motte Piquet, and received in return a salute of nine guns. This was the first foreign salute of the stars and stripes; and the subject has been commemorated in the paintings and engravings with which the public is generally familiar.

THE PRODUCTION OF PRECIOUS STONES IN 1905.

While the United States may never lead the world in the production of gems, the value of its output of precious stones in 1905 reached the very respectable figure of $326,350.

The largest output is from the sapphire mines, the yield of which amounted to $125,000. Next in value are the turquoise, quoted at $65,000. Then came the tourmalines worth $50,000. Peridots, crystal quartzes, and miscellaneous stones are accredited with a value of $10,000 each. The production of aquamarines is valued at $6,000, of kunzite, gold quartz, chrysoprase, silicified wood, and garnet at $5,000 each, of smoky quartz and chlorastrolite at $3,000 each, of amethyst, agate, pyrite, malachite, anthracite, and catlinite at $2,000 each, of moss agate at $1,500, of beryl, rose quartz, Amazon stone, and arrow points at $1,000 each, of topaz, utahlite, and mesolite at $500 each, of fossil coral at $250, and of dumortierite in quartz at $100.

Mr. George F. Kunz, who has prepared a report entitled, "The Production of Precious Stones in 1905," which will soon be published by the United States Geological Survey, is authority for these figures.

THE HEAVENS IN AUGUST.

BY HENRY NORRIS RUSSELL, PH.D.

Two eclipses occur during the present month, both of which are visible in the United States, though neither of them is observable on the Atlantic coast.

On the morning of August 4 there is a total eclipse of the moon. She first enters the earth's shadow at 6:10 A. M. (Eastern standard time). At 7:09 she is completely immersed in it, and does not begin to come out till 8:51, nor get quite clear till 9:50.

As the moon sets at 5 A. M., none of these phenomena will be visible in New York; but when we transform our Eastern standard time into Mountain or Pacific time, we see that dwellers in the Rocky Mountains will see the moon set partially eclipsed, while the inhabitants of the Pacific coast will be able to watch the complete disappearance of the moon into the shadow before she goes down.

The whole eclipse will be visible throughout the Pacific, in Alaska and in the Philippines, and its later phases in China and as far as India.

This eclipse is remarkable for its long duration, which is due to the fact that the moon goes almost exactly through the center of the earth's shadow, and so crosses it where it is broadest.

On the afternoon of August 19 there is a partial eclipse of the sun, which is visible in the northwestern corner of the United States, in Washington, Oregon, and Idaho, while in Montana the sun sets eclipsed. Only a small portion of the northern edge of the sun is obscured.

The eclipse is also visible in British Columbia and in most of Alaska, and throughout the polar regions generally.

THE HEAVENS.

Our map shows the principal evening constellations. The very bright white star almost overhead is Vega, the brightest in the Lyre. The star β Lyræ, southeast of it, is a remarkable variable, which at brightest is just about equal to its neighbor, γ, but runs down to about one-third of its brightness every twelve days, with a less pronounced minimum between times. A few nights' watching of the two stars will satisfy any one of its variability.

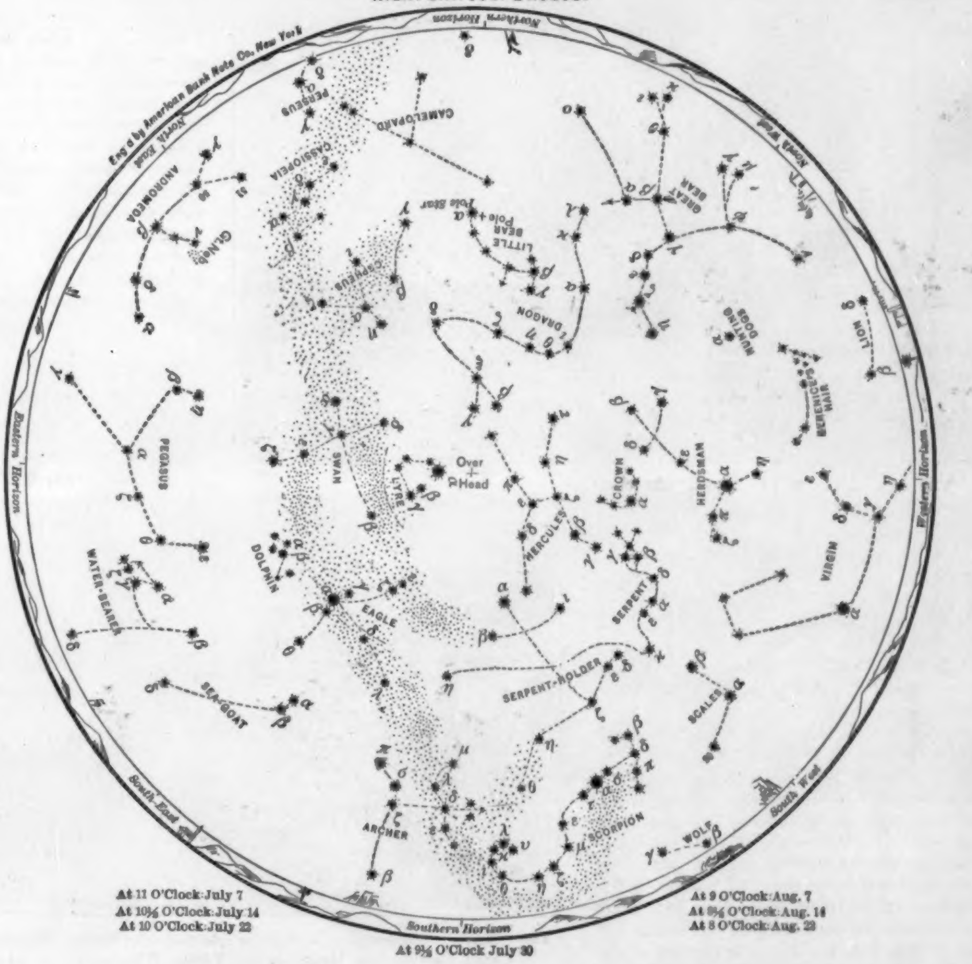
The small star shown on the map to the northeast of Vega is double, easily seen with a field-glass. A fair-sized telescope shows that each of the pair is again double. Below Lyra is Cygnus, the Swan, a very fine constellation. The cross formed by the five stars α, δ, γ, ε, and β cannot be mistaken for anything else in the heavens. Between α and δ are two small stars, of which the southernmost is a fine, but difficult, naked-eye double, while β Cygni is one of the finest telescopic double stars in the whole sky.

South of Cygnus is Aquila, the Eagle, with the first-magnitude star Altair. The line of three stars of which Altair is the middle points downward toward the two principal stars of Capricornus, the Sea Goat, both of which are double, one to the naked eye and the other to a field-glass. Pegasus, Andromeda, and Aquarius (the Water-Bearer) are all rising, but can be seen better later on.

In the south we can see Sagittarius, the Archer, and Scorpio, the Scorpion. The latter is very well shown on the map, but the former is by no means satisfactorily delineated, as several stars which are pretty conspicuous to the naked eye have been left out. Its most conspicuous figure is the Milk Dipper, composed of the stars λ, ζ, and σ, with two others. Lying as it does right in the Milky Way, it can easily be found without the map.

The extensive groups of the Serpent and the Serpent-Bearer lie higher up, and above them, right overhead, is Hercules. To the westward is the Northern Crown (so called because there is a Southern Crown, south of Sagittarius). Below this is Boötes, the Herdsman, with the bright star Arcturus. Virgo and Libra are low in the southwest. The Great Bear fills almost all the northwestern sky. Of the circumpolar constellations, the Dragon and the Little Bear are above the Pole on the left. Cepheus and Cassiopeia are on the right, and the inconspicuous Camelopard is below them.

NIGHT SKY: JULY & AUGUST



In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four-pointed; fifth magnitude (very few), three-pointed, counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

THE PLANETS.

Mercury is evening star before the 12th, and morning star after that date, and is well visible only in the last week of the month, when he rises about 4 A. M. He is in Cancer, far from any conspicuous star, and is himself uncommonly bright, and so should be easily seen.

Venus is evening star, setting at about 8:30 P. M. all through the month. Mars is morning star, but is still too near the sun to be easily seen.

Jupiter is likewise a morning star, and rises about 1:30 A. M. in the middle of the month. Saturn is in Aquarius, approaching opposition, and rises at 8 P. M. on the 15th.

Uranus is in Sagittarius, and can easily be found by aid of the star λ Sagittarii at the end of the handle of the Milk Dipper. Early in the month it is exactly due north of this star, at a distance of a little less than two degrees. It is moving westward, but covers only about half a degree during the month, and soon after begins to retrace its path. Neptune is in Gemini, rising at about 2 P. M.

THE MOON.

Full moon occurs at 8 A. M. on the 4th, last quarter at 10 P. M. on the 11th, new moon at 8 P. M. on the 19th, and first quarter at 8 P. M. on the 26th. The moon is nearest us on the 27th, and farthest away on the 12th. She is in conjunction with Uranus on the 1st, Saturn on the 6th, Jupiter on the 15th, Neptune on the 16th, Mercury and Mars on the 18th, Venus on the 23d, and Uranus again on the 29th.

Princeton Observatory.

THE ORIGINAL SELDEN GASOLINE AUTOMOBILE AND ITS BEARING ON THE PATENT LITIGATION.

Recently, in the course of the trial of the famous Selden patent case (this patent is supposed to be a basic one covering the use of a clutch between the engine and the road wheels of a gasoline automobile) the plaintiff placed on exhibition the original machine said to have been constructed by George B. Selden in 1877. This primitive automobile has a horizontal 3-cylinder engine capable of developing only half a horse-power and of driving the car 10 miles an hour. In commenting upon it, counsel for the defendant claimed that all there was in the present machine that was original in the Selden car in 1879, when Mr. Selden filed his application, was the casting of the three working cylinders, the three air cylinders, the crankcase in one casting, the crankshaft, one piston in one working cylinder and one air cylinder, and the yoke connection of that piston to one of the cranks. Everything else was new, and does not date back earlier than about last October.

Ignition in the original engine was effected by a constant flame burning on the gauze in the combustion chamber. This small flame was fed by air from the air tank through a little hole made in the air inlet valve, which little hole was always open. The charge burned as it came in and passed through this gauze on which this flame was burning. In the exhibition the other day, according to Mr. Selden's testimony, he used electricity to light that flame, and said he might continue a constant sparking to insure the flame not going out. The electrical ignition was a mere substitute for lighting this flame through the exhaust pipe after the cylinder was filled with combustible. The electrical ignition was by sparks passing between an insulated terminal and the wire gauze, so that the return line of the current was through the engine body. This engine will not develop over an effective half horse-power on driving the car at ten miles per hour with 20 pounds traction.

It is doubtful if, from the patent specifications together with what was known in the art before 1879, an operative engine and car could have been made without instructions which are not found in the specifications.

An obscure line in the drawing of the patent is interpreted without a word in the specifications to say what it is or what it will do, as a so-called wicket valve, which is said by Mr. Selden in his testimony to be novel with him. No one from the patent could know what it was or what it would do, nor would anything be found in the art in that relation which would give any light on that subject.

The patent is therefore misleading, as the engine would, according to Mr. Selden's testimony, not operate effectively without the presence of that valve, which is not described and can only be considered illustrated by a forced interpretation of the drawing, which no one would guess from looking at it. This is more than confirmed by the fact that Mr. Bentley, the complainant's expert, in his testimony in the case, interpreted the lines as the gauze and nothing else. He did not discover that there was any valve illustrated in the drawing in that position. Mr. Selden has testified that this valve is an essential feature. If this is so, he has withheld from the public knowledge regarding an essential feature in his patent, and has not disclosed completely his real invention. According to the law this alone would invalidate the patent.

The raisin production of California for the last decade has been about 895,000,000 pounds, an annual average of 89,500,000 pounds. The shipments of California-grown grapes to States farther east for the last ten years have amounted to 10,482 cars, or about 251,568,000 pounds, an annual average of 25,156,000 pounds. In 1903, on account of the short crop in the Eastern States, the shipments were greatly increased there having been over 1,800 cars shipped. In 1904 more than 1,450 cars were shipped. About 50 per cent of the grape crop in California is converted into wine and 35 per cent into raisins, while 15 per cent is shipped as fresh grapes.

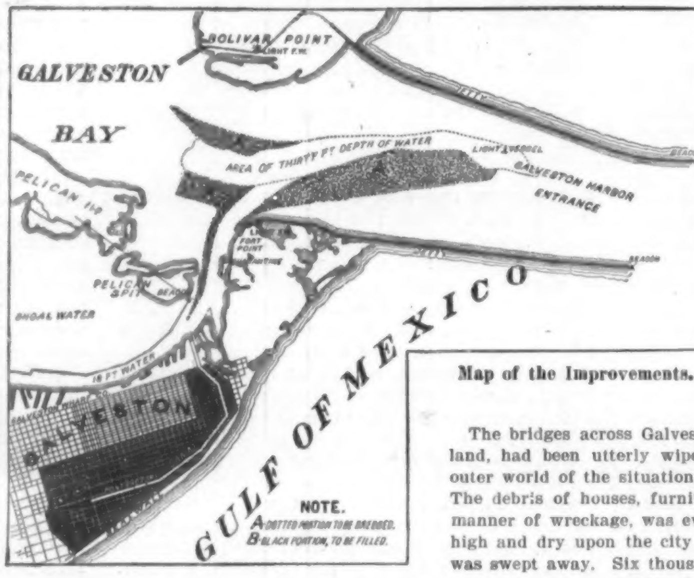
On July 13 Loring Coes died in Worcester, Mass., at the age of ninety-four. He was the inventor of the hand-screw wrench which is named after him. Despite his great age, he was still actively engaged in manufacturing.

GALVESTON—A CITY BUILT UPON SAND.

BY LINDON W. BATES, JR.

The city of security has been traditionally the one whose foundations have been buried within the rock. It remained for Galveston to establish a new order, and proclaim herself the city of safety whose foundations are not sunken, but raised high, and whose trust is set not on rock, but on sand. And sand is both the material and the moral basis of this civic home, won at such cost from the sea. It is character "sand" that has armed the city against the Gulf, and set a solid rampart to shield her whole seaward face. It is this that has secured the two monster jetties reaching oceanward like two welcoming arms—jetties which dwarf those of Cherbourg and of Dover. It is the "sand" of her sons that has raised her finances from disaster prophesying bankruptcy to a place as high as any in the Union.

Of the storm that swept her in 1900 not a trace remains, save in the memories of the inhabitants; and with the backing of a concrete wall, there is being heaped in eleven million cubic yards more to raise the grade beyond all fear of future flood. On the 6th of September, 1900, the weather report from the Gulf Islands signaled a storm advancing upon the coast of Texas. Then the storm center drifted out of observation into the great Gulf of Mexico. Two days passed, during which the people of Galveston went about their ordinary duties with scarcely a thought of an impending danger. There had heretofore been periodic storms, some of them doing considerable damage in the lower wards of the city. The older inhabitants bore in mind the one of 1875, in which a large part of the oceanward side of Galveston had been submerged, and the water had reached nine and one-half feet above sea-level. The milder affair of 1886 was also recalled, with its high-water mark of nine feet. Many who realized the unprotected nature of the town had sounded unwelcome warnings. It was shown how absolutely undefended was the residential section of Galveston, in many places at an elevation of only three and one-half feet above the sea, while the highest part of the city was elevated only nine feet. At 2 A. M. Saturday a strong wind started from the north, accompanied by a heavy fall of rain and a rising tide. By 5 o'clock in the afternoon the storm had swept in and had burst with all its fury. Before the recording apparatus had been carried away, it registered the velocity of the wind as one hundred miles an hour. The water was steadily rising. It rose five or six feet almost in a jump at about 7 o'clock. Wave after wave rolled in, and encountered a current from the bay. The two met, turned, and in a sweep across the front carried along houses, animals, street cars, telegraph poles, everything, in utter ruin. Great beams and railway ties were lifted by the stream and driven like battering rams into dwellings and business houses. Night came on with apparently no abatement in the violence of the storm. But about 10 o'clock in the evening the wind died down suddenly, and the water fell with amazing rapidity. Within a half hour after the subsidence began, it had fallen two feet. By daylight the streets were clear. But what a scene of desolation was revealed by the dawn!

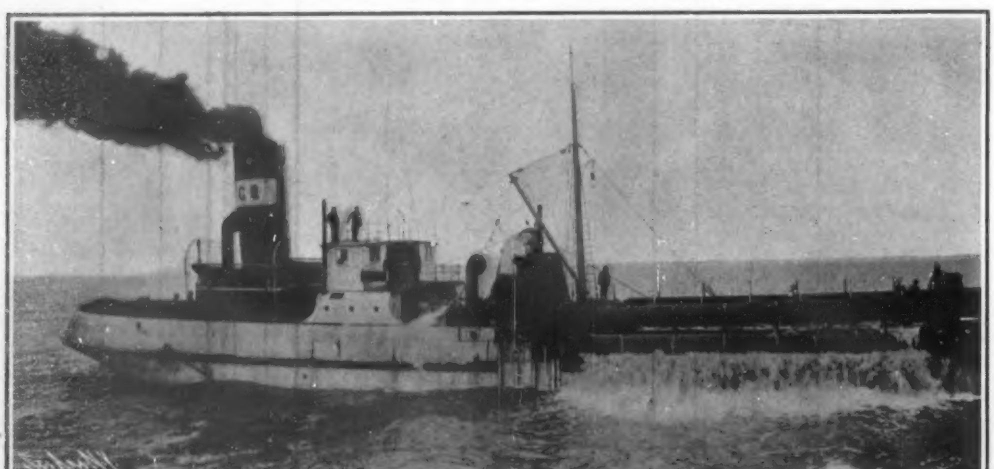


Map of the Improvements.

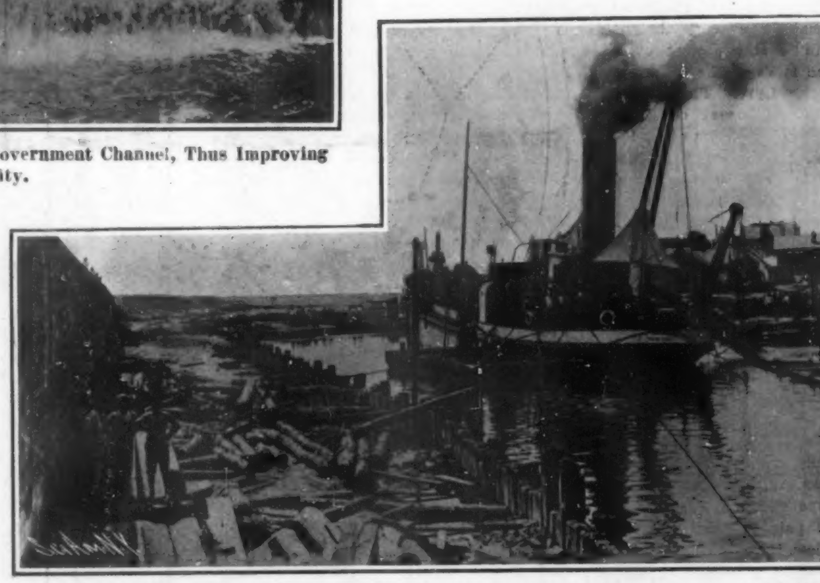
The bridges across Galveston Bay, their one connection with the mainland, had been utterly wiped out, so that no news could be sent to the outer world of the situation in the town. Drinking water and food failed. The debris of houses, furniture, bodies of men, horses and cattle, and all manner of wreckage, was everywhere. A freighter of 10,000 tons was cast high and dry upon the city docks. The residence district of the sea front was swept away. Six thousand lives, a sixth of the city's population, were lost. A broad white strip of newly-made beach, three miles long and four blocks deep, lay swept absolutely clean of a sign of a dwelling. Behind this was the bulwark of flotsam and jetsam, forty feet high in places, which piled up and saved the center of the city from the full sweep of the waves.

A leading Galveston newspaper, the year after the storm, analyzed the financial status of the city. It reached the conclusion that the utmost which could be done for safeguarding would be to drive a double row of piles along the beach in front of the city. It even doubted if, with the great losses sustained, there could be ventured the $400,000 bond issue needed to pay for this public work. A double row of piles! $400,000 bonds to pay for them! This was the utmost that the city was deemed able to bear. Yet the men

(*Continued on page 66.*)



One of the Dredgers Filling Its Hoppers with Sand Taken from the Government Channel, Thus Improving It and Simultaneously Raising the City.



The "Holm" Commencing to Dig the Distributing Canal. The Sea Wall is on the Left. The Canal Pierces the Heart of the Town. The Dredgers Steam up It and Discharge Their Loads under the Houses.

In Raising the City All the Houses Are Elevated on Stilts and the Dredgers Fill under Them. The White Mark on the Telegraph Pole Shows the Final Grade.

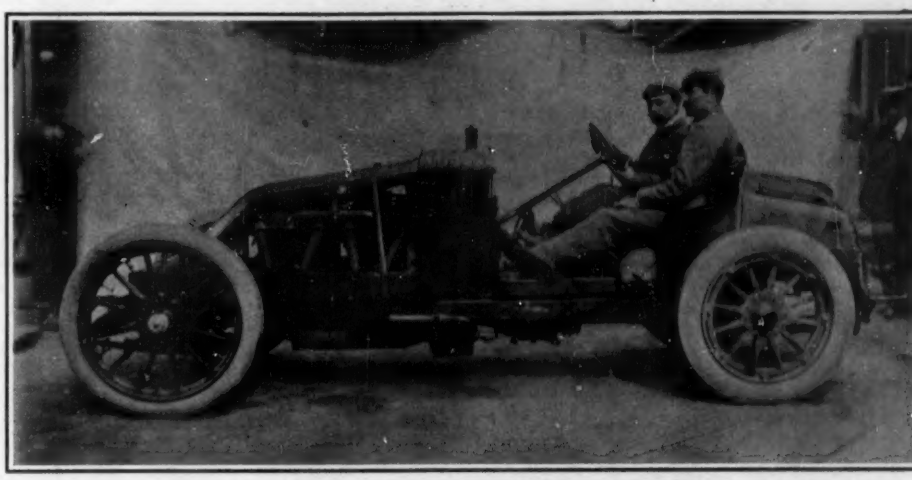
The Dredger "Leviathan" in the Canal, Showing the Undecked Hopper Space.

GALVESTON—A CITY BUILT UPON SAND.

THE WINNING CAR OF THE GRAND PRIX, AND THE NEW DETACHABLE RIM.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

As the winner of the Grand Prix, the new Renault car naturally claims the larger share of our attention. But even from a technical standpoint, the machine is worthy of more than passing notice. In the views which are herewith published, it will be seen that the main novelty is the position of the radiator. Instead of lying in front of the motor as usual, it is carried at about the middle of the chassis and in front of the driver's seat. With the radiator placed in the rear, the motor is well cleared in front, with the result that it is left entirely uncovered, and that inspection and repairs are more easily effected. The translation of the radiator to the rear has the effect of taking some of the load off the front axle, so that the car is enabled to round curves more readily. Furthermore, it is easier to carry out the gravity water-cooling method. During the race, the motor of the Renault car gave no trouble because of overheating, and Szisz, the driver, was not obliged to replenish his water tank during the whole course.



The New Four-Cylinder Renault, Winner of the Grand Prix.

The new radiator is made up of small, round copper tubes piled up vertically on a system somewhat similar to that of a steam-engine condenser. In designing such a radiator, the correct relation between the diameter of the tubes and the air current which passes through them must be ascertained.

The carbureter which is used on the radiator of the car is of the new automatic type, which gives great latitude of feed and avoids all heating. The principle of the carbureter is simple. A light metal disk is placed in the inlet pipe, and works back and forth so as to regulate the extra supply of air. A certain space is left between the disk and the inner surface of the pipe, so that a given amount of air can pass by the space.

When the suction strokes of the motor are timed somewhat apart, the movement of the disk must be regularly maintained. A liquid braking system was finally devised, a rod being connected with a piston which plunges in the gasoline, acting as a dash pot. This method of regulation makes the carbureter quite automatic, and effects a saving in fuel consumption. No trouble was experienced with this carbureter during the race. Specially to be remarked in the new racing car is the absence of the differential on the rear axle. The universal joint rod extending from the front of the car is geared to the axle by a simple pair of pedal gears. This rather unusual method of driving was found to be a great success in the race, and is an example of the special modifications which the present high speeds are likely to bring about when the design of the car is carefully selected to meet the actual conditions. In racing, the wheels of an automobile do not always adhere to the ground. On the contrary, a slight obstruction, such as a pebble, will cause them to leave the road, so that the entire machine sometimes appears to flutter along. Inasmuch as under such conditions all the wheels are not likely to touch the ground, an axle having a differential is actually at a disadvantage. This, of course, applies only to high speeds. The new four-cylinder Renault motor has little to offer in the way of novelty. One of the lightest of the series, it was designed for 105 horsepower. Its bore is 6.6 inches and stroke 6 inches. All the valves are cam-operated. A separate sheet-metal water jacket is employed. Ignition is effected by magneto and spark plug.

The speed-changing box just back of the radiator consists of a cylindrical case, and embodies the well-known features of the Renault system, which have already been described in these columns. Back of the speed-changing box is mounted a brake wheel. Then comes an aluminium case containing the joint of the main transmission rod, which passes through the rear axle. Here we also notice the lubricating oil tank. A special pump for oiling is used in connection with it to feed each of the motor bearings. From the bearings the oil passes to the crank heads of the motor.

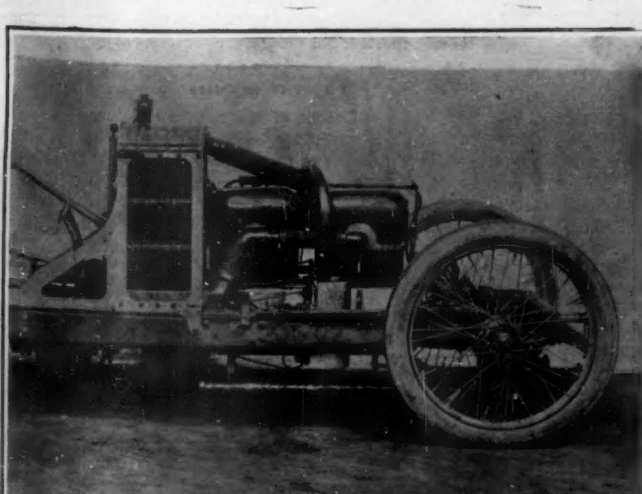
To finish the description of the Renault car, we may mention the use of a new hydraulic dash-pot device for checking the vibration of the chassis. This is designed somewhat after the manner of the recoil-cylinder brake used on high-power guns.

Description of the other cars will be found in the current SUPPLEMENT.

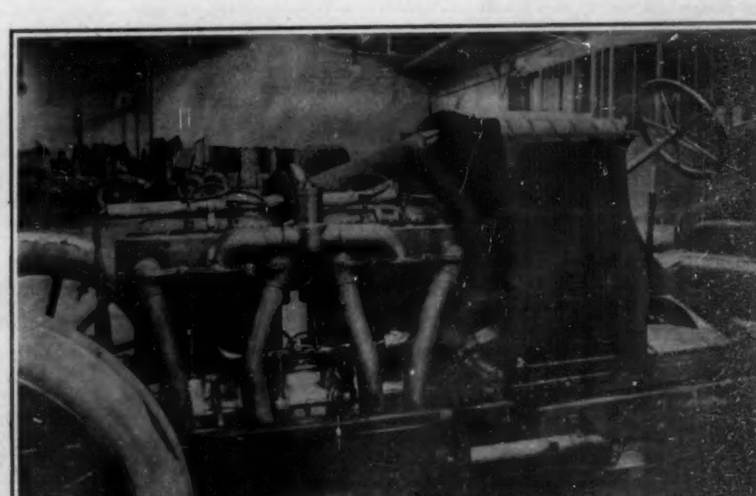
The Detachable Rim Used on the Renault.

Ready to Apply an Inflated Tire.

The Renault car is among those which used the removable system of wheel rims, perhaps the only truly striking novelty which the Grand Prix brought forth. The invention had been kept secret before the event by Michelin and the other constructors who had fitted it upon the cars. In some cases, such as the Fiat and the Itala, it was used upon all four wheels, while other racers employed it only on two wheels. The cars equipped with this system were at a decided



Forward Part of the Car, Showing Position of Radiator.



The Engines and Radiator of the Car.

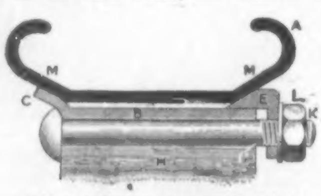
THE RENAULT CAR WHICH WON THE GRAND PRIX, AND ITS DETACHABLE RIM.

Photographs taken by the Paris Correspondent of the SCIENTIFIC AMERICAN.

advantage. On the other hand, no one knew before the race just how the detachable rim would bear up during a severe race, so that those who had pinned their faith to the new system were running not a little risk. That the new rim has come to stay, there can be no doubt. But whether there is an actual saving of time in renewing the tire, is as yet a moot point. Those who did not win claim that it was because their more successful competitors employed the new system, while the winners, on the other hand, maintain that the invention effected merely a saving of work, but not of time. During a visit to the Renault factory, I had the good fortune to meet Szisz, who gave me his opinion of the detachable rim. "It is certain," he said, "that the new rim is a great improvement, and that we may henceforth expect to find it in all races. In the Grand Prix it did not save as much time as some claim. Its chief merit lies in the readiness with which it can be removed and applied. There is nothing of the hard work which the old method entails. When working in the hot sun and without assistance, as was required by this year's rules, it is evident that the detachable rim is a boon. But so far as actual time is concerned, I believe that an ordinary tire can be renewed in five minutes by experienced men. It took me just four minutes to renew the removable rim. There is no justification, therefore, in claiming a great saving of time."

In the accompanying views, which were taken on the rear wheels of Szisz's Renault car, which was the winner, the principle of the detachable rim is clearly shown. Two systems were used—the M. L. and the Vinet.

According to the system of the Société des Jantes Amovibles M. L., on the outer edge of the road wheel are imbedded six bolts projecting about three-quarters of an inch. The detachable steel rim has the flanged edges of an ordinary rim. Six projecting ears are riveted within the circumference of the rim and near its outer edge. Each of these ears is drilled to fit the bolts projecting from the face of the wheel. The tire is fixed on this rim, the air tube inserted, and inflated exactly as in an ordinary wheel. The rim is then slid on the road wheel, the bolts on the wheel



CROSS SECTION OF VINET RIM.

passing through the ears on the rim and held in position by nuts. Provision is made for the projecting valve by a notch cut in the wooden rim. As a further security against creeping the ears are countersunk into the wooden and metal rims of the wheel. The surface of the rim coming in contact with the felloe consists of two steel rails machine finished, with a groove between them, in which are imbedded the nuts holding the valve on its seating and the bolts of the leather cover on which the air chamber rests. Being flush with the level of the rails, it is impossible for the bolts to work loose.

The Vinet consists of a double rim, one part being fixed on the wheel and the other bearing the tire being detachable. As shown in the accompanying diagram, the flat steel rim, *B*, encircling the road wheel, *H*, carries on its interior edge a ridge, *C*, against which is pressed one edge of the detachable rim, *M M*. This latter has only to be slid onto the wheel, the diameter of the wheel being about four millimeters less than that of the rim in order to make the operation easy. Five or six projections on the detachable rim fit into indentations on the fixed rim, preventing one rim from revolving on the other. The rim placed in position, a steel ring, *E*, split to facilitate mounting and having one of its faces beveled to fit against the face of *M M*, is placed over the six projecting bolts on the wooden rim and held in position by nuts, *L*. To dismount a tire it is only necessary to unscrew the nuts, *L*, take off the split ring, *E*, and withdraw the rim and tire, *M M*. A special short valve has to be employed, not projecting beyond the false rim, *M M*. To inflate the tire it is necessary to dismount it. An improved model is now being made in which the fixed rim of wood and metal is pierced to allow of the passage of a prolongation of the valve, screwing into the valve imbedded within the false rim. By this means it would not be necessary to dismount the rim to inflate the tires.

All the cars employing these rims in the Grand Prix race carried two spare tires completely inflated. The weight limit of 1,000 kilos, however, prevented several competitors from adopting them, and the private objections of drivers may have been a determining factor in other cases.

Clément Bayard and Vulpès cars were fitted with either Vinet or M. L. rims, while other firms having given them extensive trials were Darracq, Renault and Brasier. The Itala, driven by Baron de Caters, stuck to fixed rims.

GALVESTON—A CITY BUILT UPON SAND.

(*Continued from page 64.*)

of Galveston have built a solid concrete sea wall, four and a half miles long, at a cost of $1,500,000, and have paid for it in cash. They have backed the wall up with 100 feet of solid filling; they have issued and floated bonds eagerly seized in every market to the value of $450,000, as an incident to the work, and are now raising the greater portion of the city to an average height of 14½ feet above sea level at a cost of $2,200,000 further.

The sea wall was advertised, was contracted for, and was started. It required faith and courage, the type of courage that characterized the men of Valley Forge. But each day the solid wall crept farther along the Gulf front, until at length it stretched four and a half miles, guarding the whole corporate length to its outer limits. And on top of this the city has undertaken a task unknown in history, but which is now one-third completed—to lift itself bodily above the flood line. A district as large as all that part of Manhattan below Houston Street is being raised to a height in places fifteen feet above its present level. It was not an open country or a tract of waste land which was to be lifted; it was the major part of an active, vigorous town, the most important business center of the Southwest. Street-car lines, gas pipes, water mains, houses, churches, all the complex mechanism of a metropolis, had to be elevated an average of seven feet above the old grade. No less than eleven million cubic yards are needed to complete this work.

Eleven million cubic yards! The quantity conveys no definite idea to most. What it really meant for the Gulf City to undertake this work may be realized from comparisons. Galveston is the second export city of the United States. During the last fiscal year, 1905, there cleared here for both United States and foreign ports, vessels of a total of 1,762,478 net registered tons. This tonnage is an equivalent of 1,828,000 cubic yards. If every vessel clearing from the port of Galveston last year had been loaded with sand to her full net tonnage capacity, the amount carried away would be less than one-sixth of what is being used in raising the grade. The material required would make five pyramids as large as that of Cheops. If every vessel flying the American flag were required to bring one full cargo of sand, it would take three trips of this great fleet to meet Galveston's need. This is the magnitude of the public work that the city of less than 40,000 souls has undertaken with no outside aid, save the retention of its own State taxes for seventeen years.

The solution of the problem of raising Galveston was an engineering feat. No tool in America could accomplish the work within the city's resources, and hauling material by rail cost $500,000 more than the municipal tax limit would allow. Suction dredges could not pump the three miles into the heart of the town. The solution lay in the radical proposal of driving a canal into the heart of the city and using self-propelled dredges but recently introduced in Europe, which could take their loads from the ship channel, steam up this canal, and discharge the material under the houses and through the streets.

The operation of these engineering Titans possesses a certain interest. They steam over or alongside a sandbank. The main engines actuate a large centrifugal pump, whose function it is to take up material and discharge it into the hoppers. "Kriesel pompe," or whirlpool pump, was the name given it by the old Prussian pioneer who first applied this principle to hydraulic dredging. The pump forms a small maelstrom, sucking up into the interior of the dredge sand, mud, etc., with eighty to ninety per cent of sea water. Then with a full load of hundreds of tons the dredge steams across the navigable channel, up the temporary canal, and pipes the mixture onto the lots and appointed streets.

Two years more will see the accomplishment of this great undertaking. The sea wall will withstand the fury of the wildest storms. The raising of its grade will lift the city above the danger point of the highest floods. The incubus which has for so long overshadowed this *entrepot* of the Southwest will vanish. Galveston's legitimate future will have to its realization no vital barrier.

As to what that future holds, it is hard to place a limit. The natural potentialities of the location loom up prominently, and entail consequences which are unavoidable. A marked similarity to New York harbor impresses one entering Galveston Bay from the Gulf. Twist Galveston Island around so that its length points out between the jetties, and the similarity is very strong. The long, narrow peninsula, Bolivar Point corresponds roughly to Brooklyn. Texas City answers to Jersey City. Each place is the nucleus of a larger growth and of future extensions.

But New York is only one of several ports on the Atlantic coast tapping the Northern States and the West by the lake route. Galveston may be fairly ranked as the one really good seaport west of New Orleans. This means that there can be accurately classed as directly tributary, virtually all the territory beyond the belt of the Mississippi steamboat competition. It includes practically all of Texas, Oklahoma, Indian Territory, Kansas, Colorado, Arizona, and New Mexico. In the natural course of events, all foreign commerce to and from this district, and most of that with the Atlantic Eastern States, will go *via* Galveston. Now, Texas alone has an area greater than that of New York, Pennsylvania, Ohio, Illinois, and Iowa combined. It includes 170,000,000 acres, ranking in fertility well up with that of these older States. Its population is only 3,500,000. It is as inevitable as the law of gravitation that this area will be filled sooner or later with a population many times greater than it now has, and this means so much more commerce to pass through Galveston's port.

The Action of Radium on Gems.

A. Miethe, the author of a paper on the coloration of gems by radium rays, published in Ann. d. Physik, studied the action of these rays on a large number of gems, and found that many of them are influenced by the rays.

No general principles can be indicated, except that the more transparent gems show a greater tendency toward coloration than the opaque or highly-colored ones. Miethe used a preparation of 60 milligrammes of radium bromide. A colorless diamond from Borneo was colored a light yellow after eight days, and a decided lemon-yellow after another eight days. On heating the diamond to 250 deg. C. the yellow color was diminished, but it could not be entirely got rid of even at a red heat. A colorless Brazil diamond showed no coloration. A peculiar behavior was shown by a pale blue sapphire from Ceylon. After only two hours' exposure to radium bromide it showed a coloration, green at first, then light yellow, and after a few more hours, reddish yellow. After a fortnight it was a dark yellow approaching chestnut. The color could be got rid of by heating, but the light yellow color always returned on cooling. Rubies show no change, and tinted tourmalines very little. Brazil tourmalines slightly colored green and pink respectively at one end acquired the same color at the colorless ends on exposure to radium. This coloration took a day or two to appear.

The Search for Diamonds.

Never before in the history of the United States has there been such a demand for diamonds as there was in 1905. Large quantities were imported, but the country produced none. In 1903 it produced diamonds to the value of $50, in 1901 it had an output worth $100, in 1900 its production was valued at $150, and in 1899 the country boasted native diamonds to the value of $300. Diamonds have been discovered in the United States in four different regions, but their actual place of origin is in every case unknown. All have been found in loose and superficial deposits, and all accidentally. It is not at all improbable, however, that some day the original sources of this queen of gems may be discovered.

The high price of diamonds has made the recent search for these precious stones in the United States and Canada keener then ever before. A careful watch for diamonds was kept during the examination by the United States Geological Survey of many samples of gold and platinum sands at the Lewis and Clark Exposition in Portland, Ore. A lookout for diamonds has also been kept by a number of people who have been dredging for gold on an extensive scale in the rivers of California. In neither case have any finds been reported.

Paper from Cotton Stalks.

The manufacture of paper from the fiber of the cotton stalk is one of the latest inventions which are said to have passed the experimental stage. It is asserted that all grades of paper, from the best form of linen to the lowest grade, can be manufactured from cotton stalks. In addition to this, a variety of by-products, such as alcohol, nitrogen, material for gun cotton and smokeless powder can also be secured in paying quantities. Mills for the use of cotton stalks in that way may become general in the cotton-growing States. It is estimated that on an area of land producing a bale of cotton at least one ton of stalks can be gathered. Upon this basis, from 10,000,000 to 12,000,000 tons of raw material could be secured for the production of paper, which would increase the value of the South's cotton crop nearly $10,000,000.

According to a letter in the Manufacturer's Record, of Baltimore, a company has been organized under the laws of Maine, with a capital stock of $15,000,000, preferred and common, for the purpose of manufacturing pulp and paper from cotton stalks. Mr. Harvie Jordan, president of the Southern Cotton Association, has been elected president.

Correspondence.

The First Foreign Salute of the American Flag.

To the Editor of the Scientific American:

It was recently my good fortune to meet one of the direct descendants of the first foreign magistrate who formally recognized the flag of the American republic. According to my informant, the first foreign salute to the American flag was given to an American brig by a Dutch fort in the harbor of St. Eustatius, by order of the governor, Johannes de Graaff, on November 16, 1776. I was informed that there hangs in the State House at Corcord, New Hampshire, an antique portrait of De Graaff, which was presented to the State in 1807 by F. W. Cragin, of Surinam, South America, in commemoration of this significant act of the governor of the West India island referred to. Now, I have always been under the impression that the celebrated Paul Jones claimed that he had the honor of being in command of the first American ship of war to be formally recognized by a foreign government, this event having taken place when his ship the "Ranger" was at Quiberon in the year 1778, or some two years later than the date of the incident at St. Eustatius. Here is an evident confusion of dates and circumstances; and, as my informant is a descendant of De Graaff, and possesses many interesting relics of the governor, and appears to be in possession of strong historical evidence of his having saluted the flag at the date named, I should be greatly obliged if you will explain this apparent contradiction, and inform me as to the exact date and place of the first official acknowledgment by a foreign power of the flag of the young republic. Signum.

New York, July 17, 1906.

[The confusion arises from the fact that the flag saluted at St. Eustatius was of different design from that which was similarly honored two years later at Quiberon Bay. The subject is discussed at length in our editorial columns.—Ed.]

The Glidden Tour as an Endurance Test.

The seventy-odd machines that are running in the Glidden tour made remarkable progress last week in view of the conditions under which they ran. In the first day's run (which was the third stage of the tour) from Saratoga to Elizabethtown, N. Y., besides traveling over extremely rough and dangerous roads through the edge of the Adirondack forest, the tourists had the misfortune to encounter a bridge which had been broken by the heavy commissary wagon of the Fifth Infantry during a trip from Plattsburg to Albany. In order to pass this spot, a detour of 12 miles over the roughest kind of mountain roads was made necessary. A time allowance of nearly two hours was granted for this detour. During the 87-mile trip (which was thus lengthened to 99 miles) several machines almost went over precipices, and there were many narrow escapes. The truck used as a baggage wagon experienced a cave-in of the road-bed, and was only extricated after many hours' labor had been expended in building cribwork to support it. That any kind of schedule could be adhered to over such roads speaks volumes for the reliability and staunchness of American machines. Nothing so severe has been experienced by them since the 1903 Pittsburg run.

The daily stages for the rest of the week were from Elizabethtown to Bluff Point (near Plattsburg), from Bluff Point to Montreal, from Montreal to Three Rivers, and from Three Rivers to Quebec. The shortest day's run was the first mentioned (37 miles). This included a trip to Ausable Chasm, which was visited by nearly all the tourists. The other runs were about 100 miles in length. On the trip to Montreal, coarse trap rock laid loosely on the road had to be traversed for a distance of some 15 miles, and this gave the tires a severe test. One car had three punctures between checkings.

Upon reaching Montreal, 27 out of 47 contestants still had clean scores. A record repair was carried out on one well-known make of bevel-gear-drive car. The rear axle had been damaged by striking a bowlder on a mountain road. A new one was obtained, and, just after the car had made its start from Bluff Point, this was substituted for the damaged one in twenty-one minutes. On another car a broken starting crank was replaced by a new one in sixteen minutes, while other minor repairs were made to the various cars in quick time.

From the above it can be seen that the present Glidden tour is a strenuous endurance test of men and machines, which, while all very well in its way, was not the idea Mr. Glidden had in mind when donating the trophy. A touring competition over good roads, run at an average speed of fifteen to seventeen miles an hour, and in which the cars are officially observed as to their fuel, oil, and tire consumption, as well as to all repairs and replacements, would be more apropos, and would serve a useful purpose in giving the intending purchaser a good idea of what a car will do under actual touring conditions, rather than how long it will hold together in a lengthy and difficult endurance test, such as he would never ask it to stand.

An Effective Method of Repairing Iron Pipe Cracks.

A correspondent in Leadville, Col., observes that the mending of a hole or crack in a steam pipe, is a difficult undertaking. He has had three years' experience in mending water pipes, and has acquired knowledge of a number of practical ways.

When he first began this work he wound a strip of plain canvas six inches wide around the pipe, a sufficient number of wrappings being employed to prevent the water from oozing out. After the canvas shrank as much as it would from being wet, it made a waterproof mend, up to a pressure of about five pounds per square inch; if the pressure exceeds five pounds, it is not practical.

He then experimented with canvas soaked in boiled linseed oil, and found that it worked very well if it was wrapped on before the oil dried and had about ten days to dry before any water was turned on in the pipes. When it dried well, a covering over the crack was made, which was very solid, but in about three to five years it would rot and would have to be renewed. In place of the foregoing he recommends the following method, which has been found to stand every test: First, provide a sheet of lead or copper about 1-20 of an inch thick, and a spool of either copper, iron, or steel wire about 20 gage; copper wire is preferable, as it will not rust like iron and steel wire. Then take a file and smooth off the iron all around the crack or hole in the pipe. Next lay waste or some rag or asbestos steam packing of some kind all around the crack to serve as a gasket. Now take a piece of sheet lead or copper (it should be large enough to lap half to three-quarters of an inch on all sides of the hole) and lay it down smooth and tight on the gasket. Then begin at one end of the patch, and wind plenty of wire around the pipe and the patch, and with a small hammer tap it gently as the wire is being wound on. If the pressure is high, a number of layers may be used, but only a gasket is required, and one layer of sheet metal around the pipe, for light pressures.

Telegraphy and Wireless Telegraphy During the San Francisco Disaster.

By W. R. Carroll.

During the earthquake and the subsequent days of fire marking the awful calamity which all but swept the city of San Francisco from the map, and when every single telegraph, telephone, and cable wire was interrupted, the only direct means of communication with the burning city was by wireless telegraphy. One could scarcely imagine a more propitious occasion for demonstrating the triumph of wireless communication over the wire method.

The demolition of walls and even whole buildings and also broken and twisted conduits put a greater part of the wires out of commission, or else so tangled them as to make work unreliable if not wholly impossible. There was one instance where for three days immediately following the disaster, the sole means of communication with Seattle and Portland on the north was by means of the Postal Telegraph office on Goat Island, midway in the bay between San Francisco and Oakland, and that over a providentially crossed wire, until when, in the middle of one of the bulletins sent out from this office, the wires parted, and further attempts to restore the circuit were futile.

Great credit is due to those operators in the main offices of the two telegraph companies who stood by and worked the crippled wires for fully two hours after the earthquake. In spite of the falling plaster from the shattered walls and ceilings at every detonation of the exploding dynamite and gun-cotton used to fight the onrushing conflagration, they stayed by their keys, and not until the flames had already taken hold of their own buildings did they leave, each one carrying to a place of safety some part of the more valuable instruments. By this saving of the instruments they were enabled at once to establish temporary main offices in Oakland across the bay, inadequate however to handle for some time the great rush of telegrams. Cable communication with Honolulu was re-established from the cable hut on the beach, six miles from the burning city, as soon as enough battery could be collected to charge the submarine wires. Every source of electrical energy was more or less crippled, and in some cases wholly destroyed, by the earthquake, which lasted forty-eight seconds. Independent plants having storage battery were fortunate in having some available power, though the generation of further power was forbidden, because of the lack of water for steam or because of damage resulting from the fallen chimneys of power houses.

Very unfortunately the wireless station on the top floor of the Merchants' Exchange building in San Francisco and its connecting station in Oakland were both rendered inoperative for lack of current, originally derived from the lighting mains, with which to actuate their induction coils. On the second day the wireless apparatus in the Merchants' Exchange, together with everything else in that magnificent fourteen-story structure, was consumed by the flames. Previously, the operator had laboriously mounted the long flight of stairs to listen at the receiver, and found it ticking quite merrily, the etherograms emanating from the government wireless station on Goat Island. This latter station having its own current supply, a forty-cell storage battery and generating set, and suffering no damage from the earthquake, was not for a moment placed out of operation. Within a very few minutes after the earthquake the line of government wireless stations extending from Mare Island navy yard to San Diego had received wireless tidings of the city's distress. The flagship "Chicago," accompanied by the cruisers "Boston" and "Marblehead," were at sea, having sailed from San Diego at daylight, and were steaming leisurely northward to Long Branch, when these same dispatches were received by the ships' operators. Immediately forced draft was put on, and the fleet headed with all possible speed to the relief of the stricken city. While the fleet was yet over 300 miles away, complete arrangements had been made by wireless for the landing upon their arrival of medical and food supplies and an armed force of blue-jackets and marines.

At frequent intervals throughout the fire's away as it swept over San Francisco's hills, bulletins were radiated from the Goat Island wireless station to Mare Island and to the Farallones Islands, whence they were relayed to Point Arguello and San Diego farther down the coast.

Upon the arrival of the naval vessels, the flagship anchored off Fort Mason at the foot of Van Ness Avenue and within a stone's throw of the shore, where Gen. Funston, in command of the military forces, had established his headquarters. For the next two weeks the cozy little wireless office on the "Chicago" presented a very business-like appearance. Without hitch or delay an enormous lot of telegrams were handled. While the underbay cables were in a hopeless state of chaos, and telegrams were being carried by messenger across the bay to Oakland and then put on the wire, the government officials enjoyed the advantage of wireless to Goat Island and thence east. In addition to the great number of telegrams to and from the War Department at Washington were others from nearly every other branch of the government. With the Mills Building in flames, the Weather Bureau established temporarily aboard the "Chicago," where they found meteorological apparatus, and were supplied with weather reports from outside points, enabling them with their customary accuracy to make a forecast. Heralded in advance, rain fell on the fourth day, though not until after the flames had been subdued.

Learning that it was possible to reach the outside world by the "Chicago's" wireless, many of the refugees made their way to the water front and filed messages of their safety. From the "Chicago" came in telegrams to every point of the Union and cables to foreign parts.

A private wireless station in Alameda, tapping our aerial bulletin service, supplied the anxious people there with news of the disaster. During the first day of the fire, the dynamiting squad having exhausted their entire supply of explosives, a wireless telegram to the navy yard at Mare Island, thirty miles distant, brought by torpedo boat within an hour a fresh supply. In all nearly three thousand dispatches were transmitted by the wireless stations. Had not the commercial stations been handicapped by lack of having their own source of current supply, wireless telegraphy would have further demonstrated its value and advantage in cases of this kind, where every other means of communication was demoralized.

A ONE-HUNDRED-AND-FIFTY-TON ELECTRIC CRANE.

By H. J. Shepstone.

Of late years a great improvement has been noted in the British shipyards so far as their crane service is concerned. Indeed, all the well-known shipbuilding firms have now a more or less efficient crane service, both in their sheds and over the building berths. The majority of the cranes, too, are electrically driven, depending upon electricity for the whole of their operations. The one shown in our photograph may be said to represent one of the latest of these electric cranes, and is to be seen at the shipyards of Messrs. Vickers, Sons & Maxim at Barrow-in-Furness, England. It is a 150-ton crane, having a total height from water level of 180 feet, and an over-all radius of 150 feet. It is designed to take a load of 150 tons at 71 feet radius, the load being gradually reduced to 135 feet, at which distance the crane can lift 53 tons. There is an auxiliary purchase at 138 feet radius of 15 tons. All the motions—lifting, slewing, and traversing—are effected electrically from the operator's house on the under side of the lifting jib, and the crane is balanced with a cantilever arm to take the hoisting and traversing machinery and counterweight. The crane is seen lifting one of the British submarine boats. It almost looks as if the submarine could be placed on the deck of the vessel, but, of course, this is not what is intended, the boat being lifted over the ship fitting out.

MODEL MUNICIPAL SLAUGHTERING ESTABLISHMENT AT BERLIN—A LESSON IN SANITARY MEAT DRESSING.

BY WILLIAM MAYNER,
OF THE UNITED STATES CONSULATE, BERLIN.

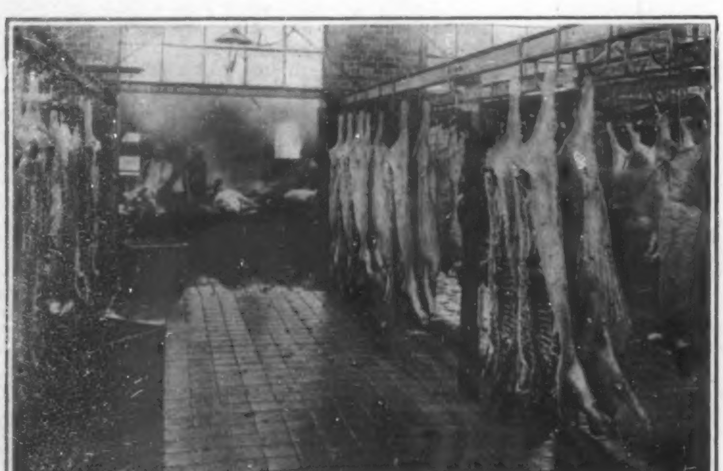
For hygienic reasons, even centuries ago, laws were enacted in certain of the European countries regarding the inspection of food, particularly meat, but we have no authentic information that special places were provided for the killing of animals until comparatively recently—that is, within the last hundred years or so. Slaughter houses are mentioned, however, as early as 1276 in Germany, but these were either in private hands or were governed by the guilds which predominated in the Middle Ages. It was not until 1868 that a law was passed in the kingdom of Prussia, which empowered its municipalities to abolish all private slaughter houses and to restrict traffic in meat brought from abroad. At this time a controversy arose in Berlin between the authorities and the owners of a private institution for the slaughtering of cattle, to whom a license to carry on this industry had been given. It was finally decided that it was advisable to do away with all the private slaughter houses, in order to guarantee that the interests of the inhabitants of the city should not be subservient to the interests of private persons. It was not till 1877 to 1881, however, that the Central Stock Yard and Slaughter House of Greater Berlin was established by the city government. The private yards were soon compelled to close, as their business rapidly declined after this, the private enterprise being unable to compete with the municipal undertaking in prices for fodder and the like, and in the superior facilities offered by the official establishment.

The markets and abattoirs of Berlin cover an area of nearly 100 acres. The cost of the establishment was over ten million marks ($2,500,000); and while the buildings have now been in use for nearly twenty-five years, constant additions and alterations have tended to keep the plant thoroughly up to date, and to make it a model establishment of its kind. The sanitary service is of exceptional excellence; the disinfection is nearly perfect, notwithstanding that its cost is comparatively insignificant. The cattle are inspected when brought to the slaughter house, and the meat is again inspected before leaving the establishment. The inspectors include veterinary surgeons, experts on trichinosis, and assistants of various grades. The surgeons are, of course, qualified for office by rigorous governmental examination, and are under oath to perform the duties of their offices to the best of their abilities. The inspection of pork is microscopic and exceptionally careful. The various processes of slaughtering and preparing the meat are regulated by the strictest of police ordinances. The cattle and other animals must be brought to the establishment by rail or wagon, and must be neither tied nor gagged. The vans or cattle cars must be so spacious that the animals need not be crowded. The regulations require a space of over one square yard for every two calves, one square yard for three sheep, and two square yards for three ordinary-sized hogs. Fowl must be transported in cages or well-ventilated boxes. It is forbidden that they be carried in bags or tied together by the feet. The greatest care must be exercised in removing the cattle to the yard, and the employés are severely punished on the least indication of brutal treatment. The pens provided for the animals, as shown in one of the accompanying photographs, are spacious, clean, and well ventilated. The live cattle are, as a rule, inspected in the pens.

Steers Are Killed by a Blow of a Heavy Hammer.

If an animal is found unfit for slaughter, it must at once be put in a separate stable. The owners or their employés must give all the information required as to such animals, their origin, etc., as well as to those that die before being slaughtered. In the latter case, the carcass is at once dissected. If an animal is to be slaughtered on account of any disease or an injury, permission must first be obtained from the veterinary surgeon in charge. Animals found to be suffering from contagious diseases are placed in a separate stable, and all the other animals which have been in contact with them are also isolated.

The carcasses of horned cattle, calves, sheep, and goats must be inspected as soon after killing as possible. The inspection includes the investigation of the condition of the flesh as well as that of the mouth, breast, stomach, abdomen, the blood and intestines, and especially the heart, liver, milt, and lungs. If



Tiled Cooling Room of the Municipal Abattoir of Berlin.

Dressing Slaughtered Hogs Under Surveillance of Inspectors.

Where Hogs Are Slaughtered. After the Day's Killing, the Entire Floor is Flushed With Water and Thoroughly Cleaned.

Interior of Calf and Sheep Slaughtering Room. The Room is Cleaned with Water After a Day's Work.

MODEL MUNICIPAL SLAUGHTERING ESTABLISHMENT AT BERLIN.

the meat is found in good condition, it is passed and stamped; if not, those parts which are good are stamped, while those found to be unfit for human consumption are turned over to the police. In case the whole is condemned, the police dispose of the entire carcass, thus preventing the possibility of its getting into the hands of unscrupulous dealers.

A record is kept of all slaughtered animals. The expert on trichinosis further keeps a special register for hogs. In case indications of trichinosis are discovered, the head of the department is notified, and he also makes an investigation. In case of necessity, the veterinary surgeon in charge can also be called upon to examine the carcass in question. All investigations as to trichinosis must be completed on the same day on which they are begun. The surveillance of the trichinosis examination is extremely thorough, and pork rejected for that reason is dealt with in the same manner as other rejected meat.

Animals which have once been brought into the yard of the slaughter house may not be taken out again except by special order of the police. The out in the most humane manner possible. Horned cattle, which are killed by a blow of a heavy hammer on the forehead, may only be slaughtered by men over eighteen years of age who possess certificates of qualification. Pigs must be stunned before cutting, and must not be placed in hot water until the bleeding has entirely ceased. Calves and sheep may be killed only on boards by means of the knife. The tying of the hind legs of the latter may be done only immediately before the slaughtering. In fact, all preparations for slaughter must be immediately followed by the killing.

From the accompanying illustrations may be seen how well adapted the various buildings of the establishment are for the purposes of the slaughtering industry. The construction throughout is of brick, stone, concrete, and steel. Wood has been eliminated almost entirely. Certain industries are, of necessity, to a certain degree uncleanly, and among these we must include that of slaughtering. Under the circumstances, the elimination of dirt and refuse is a more difficult matter than in other industries. In the cutting up of the carcasses, the waste parts, the blood, and the other useless portions must be done away with immediately, and this, of course, entails additional labor and loss of time. Notwithstanding, those in charge of the Berlin slaughter houses have accomplished this with the thoroughness we so often encounter in the German industries. The great value of the German system as exemplified in the Berlin establishment, which is regarded as a model for the stockyards and slaughter houses of the rest of the Empire, is that the regulations are not only excellent, but that they are strictly carried out.

The work of supervision in the various departments is performed with great thoroughness, and none of the workmen is given the opportunity of ignoring a regulation, even should he desire to do so. The cutting-up rooms are large and well ventilated and lighted. The cutting up is done upon removable wooden blocks, and immediately after the work is completed for the day, these blocks, as well as all other movable tools and utensils, are scrubbed with boiling water and taken from the room, which is then washed from top to bottom with the assistance of lines of hose. This method of cleaning the rooms is carried out in the entire establishment, and wherever necessary the cleansing by water is supplemented by disinfection.

Cleaning Entrails for Sausage Casings.

The Pigsties Are Clean, Sanitary and Roomy.

Pens and Municipal Slaughter House of the City of Berlin.

German Soldiers with Their Forage Carts Procuring Meat from the Government Slaughter House.

MODEL MUNICIPAL SLAUGHTERING ESTABLISHMENT AT BERLIN.

carcasses of slaughtered animals may not be cut up, taken away, or sold before inspection. The milt, lungs, and heart must be left with the natural connection to the carcass, and in the case of calves and lambs, this includes the liver. All parts of the animals must be kept near the carcass in order to avoid mistakes. For the examination for trichinosis, test pieces are taken from the red meat of the diaphragm, the belly, the head of the windpipe, and the root of the tongue. At least six microscopic investigations must be made.

The walls and floors must be thoroughly cleaned by the butchers themselves and their assistants immediately after use. In cutting up, the contents of the stomach and intestines must be discharged into receptacles erected for that purpose. No waste fragment of even the smallest size may be thrown into the gangway or the receptacles mentioned above, but must be placed in special cases provided therefor. The streets in front of the killing rooms and the passages in the buildings are kept scrupulously clean in all cases.

The process of slaughtering the animals is carried

Alloys of Calcium.

In Metallurgie, L. Stockem describes experiments which demonstrate that calcium cannot be alloyed with iron, the introduction of calcium into molten pig-iron, and into iron reduced by Al, failing to produce an alloy and only resulting in a slight decarburization of the pig-iron. Iron oxide can be reduced by calcium and forms ductile beads of iron free from Ca, even when a large excess of Ca is used. Calcium-copper alloys are readily formed by pouring molten Cu into a magnesia-lined crucible containing fragments of Ca. Even small additions of Ca make copper brittle, an alloy containing 7 per cent Ca being so brittle that bars 5 centimeters thick can be broken by light taps with a hammer. The alloy containing 20 per cent Ca is white and decomposes in air. The de-oxidation of copper by means of Ca can be readily carried out without risk of leaving Ca in the copper; an ingot of copper prepared by melting pure electro-copper in the blowpipe flame and subsequently deoxidized by means of an addition of Cu-Ca alloy, was suitable for wire-drawing without further treatment. Mg and Al also form alloys with Ca in all proportions; both metals render Ca brittle, and an alloy containing 10 per cent of either can be powdered in a mortar. Where chemical purity is not essential this provides a means for obtaining Ca in a finely divided state. An Al-Zn alloy much used for electrical purposes has also been rendered tougher by the use of Ca for deoxidization. While Ca cannot be used in the production of steel, it is likely to be useful in refining copper and nickel.

In a recent article in a German paper, Herr Paul Speier shows that the spontaneous ignition of zinc dust is out of the question when the material is properly packed. Wetting of the material is also without danger. Ignition and explosion can only occur in the presence of air. The matter is of some importance, inasmuch as steamship owners sometimes refuse to transport this material, and fire underwriters have stringent regulations with respect to it.

A MONSTER SHARK CAPTURED.

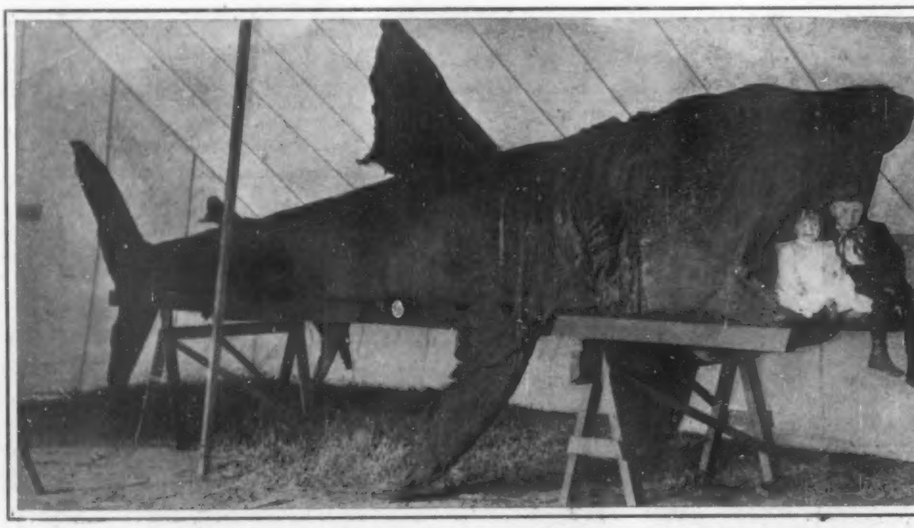
BY J. MAYNE BALTIMORE.

Sharks often attain a very large size along the Pacific coast, especially off the shores of Southern California. Very recently, a monster shark was captured by two Italian fishermen in San Pedro Bay, that is claimed to be the largest fish of that kind ever caught in the world. Beyond doubt it is certainly one of the largest ever captured anywhere.

When drawn out of the water and killed, this sea monster weighed 14,000 pounds. It measured from tip to tip 32 feet, and the circumference of the body just forward of the huge dorsal fin was 15 feet. Across the fearful mouth—horizontally—when opened it was 2½ feet, while from the tip of the snout to the point of the lower jaw it measured 3½ feet. The size of the huge mouth may be judged by the photograph—being large enough for two children to be comfortably seated therein.

The shark became hopelessly enmeshed in some 1,500 feet of the fishermen's net. The net he speedily tore into strips, but in the giant creature's efforts to escape, the strings and ropes were wound many times around its gills, and the shark was held a fast prisoner. Despite its long and frantic struggles for freedom, the shark was finally stranded and killed with harpoons. The struggle lasted for more than an hour. The monster's stomach was found full of fish. It was engaged in robbing the net when it became entangled.

So far as here known, the largest shark yet caught was 22 feet long—10 feet shorter than the San Pedro Bay monster. In capturing the latter the two fishermen had many narrow escapes from being snapped up by the creature. It made a long, savage, and desperate struggle for its life. The shark was skinned and stuffed, and has been placed on exhibition. Efforts, it is understood, are being made by the Smithsonian Institution to secure this splendid specimen of the shark family.



A SHARK 32 FEET LONG, CAPTURED AT SAN PEDRO BAY, CAL.

Aluminium-containing Plants.

Aluminium is the radical of clay, for what the chemist designates as clay is merely a combination of aluminium and oxygen in certain proportions. Now since clay (as the name already indicates) is contained in all argillaceous kinds of soil, we may at once conclude that this element has a vast distribution in the superficial strata of the earth. Hence it would be wholly inexplicable if plants were to take up from the soil no aluminium whatever, or only in exceptional cases. Hitherto, however, only a very few vegetable growths have been known in which aluminium can be shown; especially, snake-moss (*Lycopodium*). To clear up this discrepancy, the University of Odessa appointed a competition in which further investigations on the presence of aluminium in plants were to be conducted. Two young Russian botanists who devoted themselves to the task have reached the result that all the plants investigated by them take up aluminium in greater or less quantity when it is made accessible to them in proper form, and that, too, not only from the soluble but also from some salts insoluble in water, as from clay phosphates. That aluminium has been so seldom found in plants, is to be explained by the fact that it is retained mostly or wholly in the roots. Above all, however, it is to be considered that aluminium, in spite of its general distribution, is but seldom contained in such combinations in the soil as can be worked up by the plants. That is an advantage, indeed, because the soluble salts of the clay even when greatly diluted exert a poisonous effect upon plants, especially upon the roots when the clay is touched while they are still in rapid growth. Yet—as is indeed very often the case also with the effect of poisons upon the human and animal organisms—small quantities of aluminium may be absolutely helpful in the development of the plant.

The Heart of Rameses and Its Chemical Composition.

An interesting report concerning the durability of cardiac muscle has been presented by Prof. Lortet, of the French Academy, who has been concerned in investigations in regard to the condition of the heart and viscera of the embalmed body of King Rameses II., who died 1258 before Christ—3,164 years ago. There were four vases which contained the remains of internal portions of the body. Three of these were of certain indeterminable granular substances mixed with pulverized soda, and are respectively considered to be the remains of the stomach, liver, and intestines of the dead king. The lid of the fourth vase was ornamented with a jackal, and when opened it was found to contain the heart, the appearance of which was an oval plate. So solid and horny was the tissue, that it could not be severed without the assistance of a saw.

Alcohol Investigation for the Government.

As a result of the passage of the bill allowing the production and utilization of alcohol for industrial purposes, without the internal revenue tax, the Department of Agriculture has decided to publish a bulletin on the 1st of January, 1907, when this law goes into effect, placing before the public a collection of the best obtainable data on the use of alcohol in small engines. For this purpose Prof. Charles E. Lucke has been retained by the Department as expert to conduct a protracted series of investigations in the laboratories of Columbia University. The bulletin will contain all of the work done on the subject both here and abroad, as far as it is possible to obtain the same, and it will constitute a very complete bibliography, giving as well the results of experiments and the conclusions drawn therefrom regarding American engines. It is hoped that all those interested in this question will forward to Prof. Lucke any information of which they may be in possession, or inform him of the location of existing data. Possessors of patents covering inventions bearing upon the subject will do well to provide Prof. Lucke with copies of the same, and if possible to submit all apparatus intended for the utilization of alcohol, such as vaporizers, carbureters, or engines complete. These will be tested in the most thorough manner, and the experiments will be conducted without any expense whatever to the public, except for the transportation of the apparatus. The reports of the tests will be published in the bulletin. Information or apparatus should be addressed to Prof. Charles E. Lucke at Columbia University, and they will be returned when the work is completed, due acknowledgement being given for the assistance rendered.

The Current Supplement.

A very thorough description of the more prominent cars which took part in the Grand Prix opens the current SUPPLEMENT, No. 1595. Good pictures accompany the text. Mr. Herbert C. Sadler writes on the present status of the turbine as applied to marine work. Although the high-speed motor boat has claimed much attention during the last two years, it is a very recent introduction. A paper by James A. Smith discusses the modern types of high-speed launches which have been rendered possible by the developments in internal-combustion motors since the present century opened. Mr. H. Dollman writes in an entertaining vein on Summer Lepidoptera. The paper on "Insecticides: Their Preparation and Use," is concluded. Dr. Oskar Nagel gives a few helpful suggestions on the utilization of gas from suction producers. Nobody has ever satisfactorily explained why it is that we see objects in their true position, although our eyes are really constructed to give inverted images. The Abbé Noguier de Malijay writes on a new theory based upon anatomical facts. The Abbé's paper is published in the SUPPLEMENT. A Methodical Experimental Study of the Aeroplane is undertaken by Victor Tatin. In an article entitled "Astronomical Consequences of the Pressure of Light," the views of Prof. Poynting are presented.

THE FLAMING ARC LIGHT.

BY A. FREDERICK COLLINS.

The flaming arc light and lamps for producing it were brought to the immediate attention of the American electrical fraternity by Prof. André Blondel, of the Ecole des Ponts et Chaussées, Paris, during a visit of that learned savant to the United States in 1904. At this time he read a paper treating of the production, properties, and applications of all the various kinds of arc lights. Especially interesting is that portion relating to electric arcs formed between mixed electrodes—that is, carbon impregnated or mixed with mineral substances, and those carbons having cores in a cylinder of pure carbon containing one or several longitudinal canals of small cross sectional area, and filled either with mineral substances only, or preferably with mixtures of carbon; these are the kind used for the production of flaming arcs.

The history of mixed carbon is a long one, its origin dating back to 1876 when Jablochkoff invented that extremely simple type of arc lamp termed the electric candle. It will be remembered that this lamp comprised two parallel and stationary carbons fixed in their relative positions by a small amount of the kind of clay called kaolin, which cemented them together, and not only did this inventor employ this material to insulate his carbons but also to fill their central cores. The object, obviously, of filling the cavities of the carbons with this substance was then, as it is now, to increase its light-giving properties, and there are many kinds of matter since discovered that assist in this direction. Du Moncel found that the addition of the salts of lime, provided the proportion was high enough, doubles the light for an equal section of carbon; Archereau and Carré ascertained that the same was true of the salts of calcium, magnesium, and strontium when mixed with the paste of carbons. These and many other experiments were made along in the seventies.

To augment the conductivity of the arc Carré added the borates of soda, potash, magnesium, etc., to the carbons by mixing or by impregnating them before they were molded, while Faissner showed that the addition of boric acid aided greatly to make the arc more stable, while Wortley, Lacomb, and others added silicates, sulphates, chlorates, and phosphates to the carbons either before or after molding, in order to reduce the combustion.

To the researches of Bremer are we more strictly indebted for the invention of the flaming arc, for he has shown that by mixing, or mineralizing the carbons, as it is called, with compounds of calcium, strontium, and magnesium in the proportions of 20 to 70 per cent a long and brilliant arc can be secured.

The flaming arcs thus far shown in this country produce a light yellow, red, or vivid white light according to the carbons used; the addition of the salts of fluoride, bromide, and iodide of lime give the light the yellow tint, while other salts of lime give the flame a red color. In the early lamps of Bremer the positive electrode was made of pure carbon and the negative electrode of mineralized carbon. The vertical axial arrangement of the electrodes the inventor did not find satisfactory when carbons mixed with mineral substances were used, owing to the interference of the slag which, when melted, falls upon the negative carbon and prevents the free passage of the current. To obviate this difficulty he designed a new lamp, and instead of placing the carbons in a vertical position and in alignment, he set them so that they converged with their free ends downward, as shown in the illustration. Ordinarily, when the carbons are thus mounted, the arc would form above the points of the carbons; but by introducing an electromagnet above the arc, the latter is projected by the repelling influence of the magnetic lines of force below, which not only permits the slag to flow away easily, but to maintain the arc in a stable condition and increasing its efficiency. This lamp was shown at the Paris Exposition in 1900, and created much favorable comment.

As M. Blondel points out, the principal phenomenon exhibited in the arcs produced with mineralized carbons is the lengthening of the arc. For equal voltages the length of a direct-current arc, which then becomes a flaming arc, is five times as long as an arc between solid carbons. Then, again, the aspect of the arc with properly-mixed carbons becomes quite abnormal, and there is no longer a great and brilliant crater on the

positive carbon, but instead a very small surface of vaporization, its light being not much greater than that of the arc itself, which now becomes extremely brilliant; in other words, it is no longer the incandescence of the carbons that supplies the chief source of light, but the arc or flame, as luminous as though it was taken from the sun.

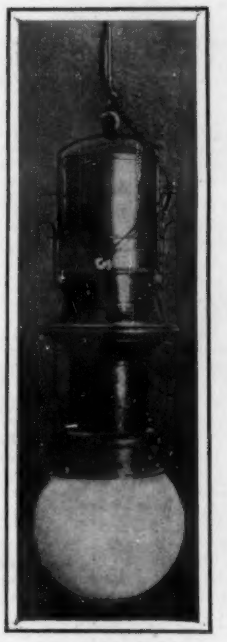
During the past five years many improvements have been made, not only in the carbons, which in some instances have, in addition to the substances enumerated, a metallic core arranged to give a good electrical contact along the entire length of the carbons, this scheme greatly reducing the ohmic resistance. The lamps for utilizing mineralized carbons are made for either direct or alternating currents. In one of the recent makes of lamps a metal base is held in a ring fixed to the lower ends of the supporting rods; attached to the top of this base is the mechanism for striking the arc. When the current is switched on the shunt magnet is energized, its action attracting the armature raising the rod, and through a sliding device the carbons are brought together; the arc is struck by the current flowing through the series magnet, its pull on the armature drawing the carbons apart. As the carbons burn away, the shunt magnet becomes more powerful and the rotating disk is caused to revolve in the reverse direction and feed the carbons. The length of the arc between the ends of the carbon electrodes is about 1½ inches. The carbons are designed to burn from 10 to 17 hours, the time depending on their length, which ranges from 12½ to 24½ inches, and a diameter which varies from ¼ to ⅜ of an inch. When the carbons are completely consumed, the mechanism ceases to feed them downward, the shunt circuit is then automatically broken by a carbon-faced switch, and this break causes the series magnet to draw the carbons far enough apart to extinguish the flame. On higher potentials than 125 volts, a blow-out magnet is employed to extinguish the arc. To produce the best results two of the flaming arc lamps should be burned in series on 110 or 125 volts, or four in series on 220 to 240 volts.

Further, this rough comparison is backed up by actual figures. In tests made at the electrical testing laboratories it was found that one of the flaming arc lights using 360 watts gave an average of 1,560 mean hemispherical candle-power, while the inclosed arc requiring 413 watts gave 265 candle-power. By "mean hemispherical candle-power" is meant the total quantity of light given out below the level of the lamp. In interior lighting this is the only part of the light that is of any practical value, as all the rays radiated upward are lost; and in the vast majority of cases of interior lighting, only the light below the level of the lamp is useful. In other words, the flaming arc light using 13 per cent less current during the tests gave 600 per cent more of useful illumination than the inclosed arc light.

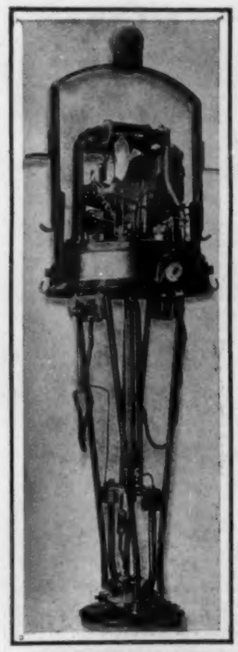
PROPOSED SYSTEM OF GUARD RAILS FOR THE SUBWAY.

Although the Subway system, in spite of the great number of trains and the speed at which they are run, has suffered very few derailments, and these few fortunately have not been attended by any serious results, it is well understood that if an 8-car, 350-ton express train should be derailed when it was running at high speed around a curve, it would result in a serious wreckage of the cars and probable fatalities and wounding of passengers. The SCIENTIFIC AMERICAN has, more than once, pointed out the advisability of placing horizontal lines of guard rails on the columns which support the roof of the tunnel, with a view to preventing the end-on impact of the cars; for we believe that in addition to the wrecking of the cars, there would be a possibility of the carrying away of some of these columns and the fall of the roof above. We have been favored by Mr. Louis H. Martin with the accompanying drawing of a design which he has worked out for the protection both of the cars and the tunnel structure from the consequences of a derailment. It includes the mounting of four lines of column guard rails, two on each side of each track, the rails being mounted on brackets, with the proper amount of clearance provided both on tangents and around the curves. To prevent the comparatively frail superstructure or body of the car from bearing directly on the rail, our correspondent suggests the mounting at each end of the car of four vertical steel rollers, so placed as to bear in case of derailment against the corresponding guard rails.

It has long been recognized by railroad engineers that the higher the guard rail for the car wheels is carried, the less is the risk of the wheels biting the rails and climbing over them. It will be noticed that in the present design, the wheel guard rails are mounted upon brackets bolted down to the ties, and



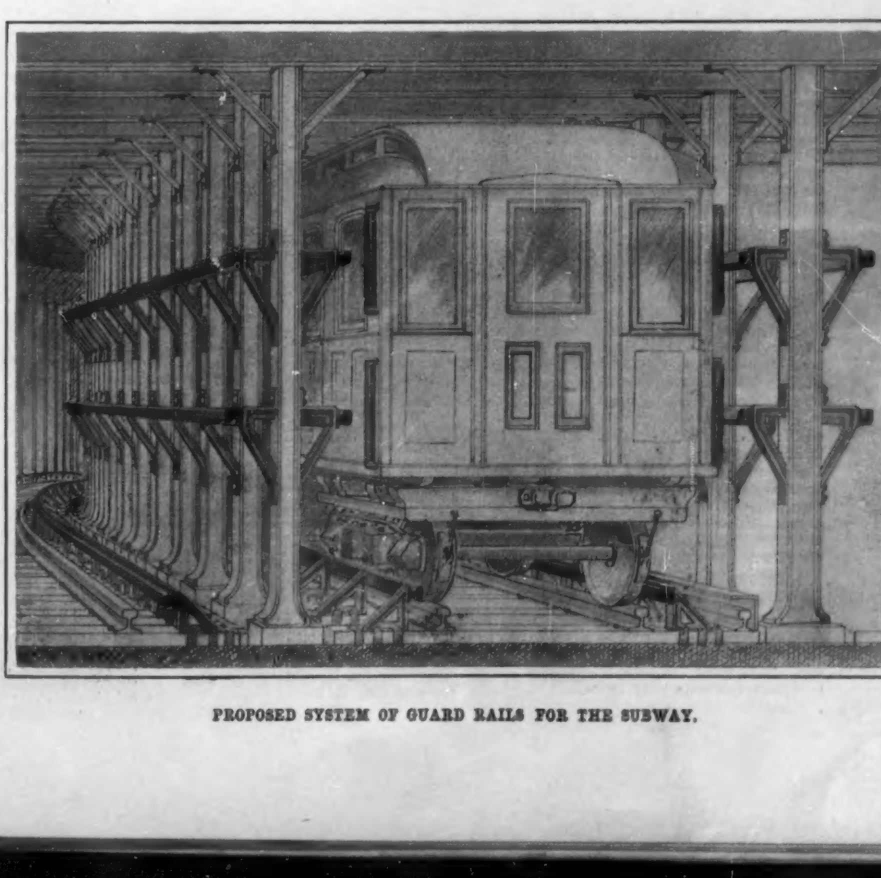
THE FLAMING ARC LAMP.



MECHANISM OF THE LAMP.

that they are carried at about double the height of the guard rails which are at present commonly used. Consequently, in the event of derailment, the wheels would run upon the ties, and the guard rails would bear against the wheels at a point about 12 inches above the bottom of the wheel tread, thus providing a very effective check to guide the trucks parallel to the rails and prevent the car from swinging over into the line of columns. Care, of course, would have to be taken to adjust the wheel guard rails at such a height that they would not be struck by the axle boxes, even when the wheels were off the track.

We consider that the general principles upon which our correspondent's design has been worked out are correct, although the particular method adopted is more expensive than would probably be found to be necessary in practice. It might be found that the brackets carrying the column guard rails could be dispensed with and a single deep flange rail substituted for the two rails proposed; for, in view of the excellent protection afforded by the wheel guard rails, we think that a single line of column guard rails, located at the level of the upper tier shown in our engraving, would probably be found to be sufficient.



PROPOSED SYSTEM OF GUARD RAILS FOR THE SUBWAY.

The Effects of Altitude.

Every year M. Janssen, the well-known director of the observatory at Mont Blanc, intrusts a corps of robust savants with the commission of observing for five or six days the phenomena of different kinds peculiar to high altitudes. For example, last summer MM. Guillemard and Moog confined their studies to the physiological field and they have communicated their results to the Academy of Sciences. These gentlemen spent five days at the summit of Mont Blanc (4,810 meters—15,781 feet) and three days at the Grands-Mulets (3,050 meters). They noticed, in their own case, that the beneficial action of the altitude (shown at first by a perceptible acceleration of nutrition) ceases abruptly at the end of a few days, and that everything then returns to the previous condition. This observation adds nothing to our knowledge. It has been known for a long time that at high altitudes (3,000 meters and upward) the "crack of the whip" by which the organism at first benefits is followed not only by a return to the normal, but often by a depression that renders a prolonged stay more or less painful, according to temperaments. The phenomenon does not occur at the "cure" stations, whose elevation exceptionally exceeds 2,000 meters, and the persistence during the whole stay of the beneficial effects of altitude is no longer contested. Let us remark, too, that the altitude cure admits of a very variable period of acclimation. MM. Guillemard and Moog were at the summit of Mont Blanc eight days after having left Paris. It was at the descent, and not at the ascent, that they stopped at the intermediate station at the Grands-Mulets; from then, the observations that they made upon their persons present a case essentially their own and having but an anecdotal interest.

Moreover, years ago the physicians of the Engadine (average altitude 1,800 meters) scientifically demonstrated the beneficial influence of the altitude cure; at the end of a few days the number of the globules of the blood increases in considerable proportions. When the subject redescends to the plain this number returns very quickly to the normal, if this normal was reached previously; in the contrary case, the subject benefits by an increase that lasts quite a while. The reality of the phenomenon, long contested, is admitted to-day by those few physiologists who have studied the question—notably Profs. Regnard, of Paris, and Lépine, of Lyons. It is, nevertheless, sometimes asked whether this hyperglobulation shown by the blood drawn to the periphery is produced in the entire circulation. MM. Guillemard and Moog, desirous of investigating in their turn this especial point, took to Mont Blanc four guinea-pigs and six white rats. By means of delicate punctures, they proved that merely the *peripheric* hyperglobulation (increase in the number of the globules) manifested itself from the second day, *almost* always compensated by a *central hypoglobulation* or diminution. In all cases, the average quantity of hemoglobin attached to each globule diminished with the altitude. MM. Guillemard and Moog do not hesitate to consider this fact as a powerful argument in favor of total hyperglobulation. It is perhaps prudent not yet to draw practical conclusions for the human species from the state of health noticed in a half-dozen rats suddenly condemned to spend three or four days on the top of Mont Blanc. These observations, however, can but theoretically strengthen the opinion which experience creates as to the salutary effects of the altitude cure.

Notable Increase in Shipping at Antwerp.

The total amount of shipping entering Antwerp during 1905 was 6,034 vessels with a total tonnage of 9,850,592 tons, showing an increase of 182 vessels and 450,257 tons over that of the previous year. This increase is considerably larger than that of the year 1904 over the year 1903, which amounted to 268,504 tons; and the returns for 1905 may, therefore, be considered as highly satisfactory for the Belgian port. The increase in British shipping accounts for the greater portion of the augmentation, inasmuch as the vessels and tonnage entering under the British flag amounted to 2,210 vessels and 4,996,704 tons—increases of 103 vessels and 375,490 tons respectively.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

SKIRT-SUPPORT. — MARGARET A. MCOUAT, New York, N. Y. This support is such as is worn by ladies for supporting the skirt at the waist. The object of the improvement is to provide a support or fastening which will afford means for supporting a skirt from a shirt-waist in a substantial manner, and, further, to provide such an arrangement as will enable the shirt-waist to be laundered with facility.

RUBBER FOOTWEAR. — P. MACA. MACKASKIN, Tonopah, Nev. One of the purposes of the invention is to provide a rubber boot which will have ventilating openings in the foot-section thereof leading to channels which are conducted to the upper portion of a boot, for example, the knee type, and also to so construct a hip-boot that sundry of the channels will lead to the top of the hip-section and others to the top of the knee-section when the former is folded down on the latter, thus providing for a thorough ventilation, under all conditions of use.

Of Interest to Farmers.

DRAFT-EQUALIZER.—F. LINDSTROM, Marquette, Kan. This equalizer comprises a horizontally-rotatable member mounted upon the tongue or draft-beam of the wheeled structure with which the improvement may be employed, together with special means coöperating with said member for effecting the desired equalization of draft, whether three, four, or five draft-animals be employed abreast of each other.

Of General Interest.

MOORING.—W. H. PEEK, United States Army. Submarine mines are usually anchored to float a fixed distance below the surface, and difficulty has been met in mooring the mines at the desired position. The inventor's object is to overcome this disadvantage, and such end is attained by arranging the anchor to slide on the cable until the anchor reaches a point above the bottom equal to distance below the surface that it is desired to float the mine. This distance is determined by a finder weight and line which automatically throws into action a clutch, causing the anchor to be fixed to the cable, whereupon the anchor in moving into the bottom draws down the mine to desired depth.

SASH-FASTENER.—I. A. SHAW, Leavenworth, Kan. The invention is especially adapted for use in connection with sashes which open by sliding vertically in guide-strips. It will operate to maintain a sash in any desired position. Also to maintain a window-sash firmly against its guide-strips. In connection with the fastener means are provided that coöperate with the fastener for locking the sash in a closed position, and so that it may not be opened from the outside.

Hardware.

PERMUTATION-LOCK. — O. KATZENBERGER, San Antonio, Texas. The object here is to provide details of construction for a lock, and more particularly to improve and simplify construction of the lock formerly patented by this inventor, said improvements being also applicable to various locks of the class indicated, in which the features of novelty may be advantageously embodied, thus providing a lock convenient to operate, may be unlocked in the dark by the sense of touch or by sound of impinging parts, or by both means.

Heating and Lighting.

GRATE AND FIXTURES THEREFOR.—J. FERRACIOLI, New York, N. Y. The invention relates to improvements in grates intended especially for use in cooking stoves or ranges and to improvements for mounting the grate. The object is to provide a grate which may be heavily constructed, so as to render it as durable as possible, but which may be made in sections, so that one or more of the sections may be removed when injured and replaced by new sections, thus permitting ready repair.

Pertaining to Vehicles.

MEANS FOR SIGNALING ON AUTOMOBILES OR THE LIKE VEHICLES.—E. BARBAROUX and G. BARBAROUX, Via Ospedale 1, Turin, Italy. In this patent the invention has reference to improved means for giving signals on automobiles or the like vehicles more readily and effectively than hitherto, and has for its principal object the employment of the exhaust-gases from the motor for operating any convenient or known signaling device, such as a whistle or a siren or the like.

WHEEL.—I. W. GILES, New Bedford, and C. W. TOBEY, Fairhaven, Mass. This invention is an improvement in wheels, and especially in wheels designed for use on automobiles and the like wherein a cushioning and a strong traction effect is desired. As a whole it may be found in practice to possess all the elasticity of a pneumatic tire without many of the troubles incident to that form of tire, the improved wheel being puncture-proof and so constructed that dirt, grit, and mud cannot enter or obstruct the working devices.

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Inquiry No. 8239.—For manufacturers of pressing machines for making tin toys.

Inquiry No. 8240.—For manufacturers of water wheels for irrigating purposes.

Inquiry No. 8241.—Wanted, address of Shipman Steam Engine and Boiler Co.

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Inquiry No. 8244.—For manufacturers of clothespin machinery.

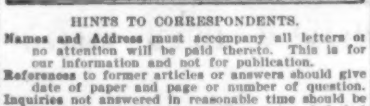
Inquiry No. 8245.—For manufacturers of charcoal machinery.

Inquiry No. 8246.—For manufacturers of sand brick-making machines.

Inquiry No. 8247.—For manufacturers of public rifle ranges, especially the glass ball and water jet device.

Inquiry No. 8248.—For address of Solar Furnace and Power Co.

Inquiry No. 8249.—For address of manufacturer of Benj. Keyes patent egg box or shipping carton.



HINTS TO CORRESPONDENTS.

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Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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(10081) H. A. says: A cask of water is placed on a pair of scales. It weighs 50 pounds. If a fish weighing 15 pounds (salmon) is placed in the water contained in the cask, will it raise the weight of the cask or not? It is argued by some apparently smart men, but I want to lay down your word to them as proof. I contend that the cask then weighs 65 pounds. A person weighs 140 pounds before dinner; does he weigh any more after a hearty meal, say of 1½ pounds? It is generally contended here that he does not. I say he does. Who is right? A. If a cask full to the brim with water has a live fish put into it, as much water as the fish displaces will overflow. As a fish weighs the same as the water it displaces when floating in water, it follows that the cask full of water and fish weigh the same after the fish has been put into the water that the cask and water weighed before the fish was put into the water, that is, 50 pounds. If the cask was not full of water when the fish was put into it, and if no water overflowed when the fish was put into the cask, the weight of fish, water, and cask will be 65 pounds in the case you specify. The whole turns upon whether the fish is alive and whether the cask is completely filled with water. If a person is weighed after a meal, he will weigh as much more than he did before the meal as the weight of the food he has eaten. Common sense teaches this. If a person puts 1½ pounds of food into his pocket and gets upon scales he will weigh 1½ pounds more than without the food in his pocket. Write stomach in place of pocket, and you will have the same fact. Or put nails in place of the word food. It will be equally true.

(10082) J. A. H. asks: Will you kindly explain how voltmeters and ammeters can be read to 1-10 their divisions? A. A scale is usually read to a tenth of a division by estimating the fractional part in tenths with the eye. This is of course not accurate, but the best that can ordinarily be done. The error, with experience, need not exceed a tenth. Sometimes voltmeters and ammeters are provided with shunts, which change the value of a division of the scale. Thus you can have a shunt made which will make one division have one-tenth of its present value. This will be much better than to estimate by the eye the fractional part of a division indicated by the pointer.

(10083) W. D. O. says: I would like to know the composition of the preparation with which the particles of carbon, in the carbon pencils for electric arc lamps, are held together; that is, the cementing substance. A. Arc light carbons, carbon plates for battery cells, and similar articles are made from coke. The higher grades are made from coke derived from the residue of petroleum stills. The crude material is dried, ground fine, and sorted into different sizes. The binding material may be a coal-tar product, or some other substance containing carbon, and which will be reduced to carbon by the heat of the furnace. These are thoroughly mixed, pressed into forms by hydraulic pressure, and afterward baked in a furnace. For a full description see SUPPLEMENT, No. 1237, price ten cents.

(10084) R. S. C. asks: Why, if known, does the skin of a chameleon change in color, in moving from an object of one color to one of another color; that is, why does its skin always assume the same color as the object it may be resting upon? A. One answer to the question, "Why does the chameleon change the color of its skin?" is that the chameleon has a better chance of life by reason of this protective resemblance to its surroundings. Those chameleons which had the largest range of change of color in the past have survived, and the capacity of change has been evolved in their descendants to a higher degree, so that all chameleons now living readily change the color of their skins to that of the bark of the tree upon which they at the time may be. They are thus protected from their enemies. There are many such adaptations of creatures to their habitat or environment. The polar bear, living among Arctic snows, is white. The tiger in the jungles is striped, as if painted to resemble rushes, reeds, or other stiff and straight plants. Many fish have backs of the hue of the sand or sea bottom upon which they lie. Nature has thus attended to the needs of her weaker children. Another answer might be that the effect of the color of the surroundings is to produce a change in the pigment in the cells of the skin, so that the color becomes like that of the surface upon which the animal is resting. In the chameleon this is comparatively rapid.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending July 10, 1906.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Abdominal supporter, K. L. Storm 825,561
Accumulator controller, G. P. Dike 825,383
Adding machine, F. E. Welton 825,365
Advertising lantern, F. Koenig 825,663
Air brake governor, L. F. Williams 825,786
Air compressor, hydraulic, M. F. Gutermuth 825,719
Alcoholic spirits, producing, G. W. Palmer 825,342
Alloys, producing low carbon ferro, E. F. Price 825,348
Ammonia from gases, extracting, R. Brunck 825,297
Anchor, C. B. Cook 825,587
Animal releasing device, J. W. Ross 825,352
Anode support, F., F. H., and W. A. Engelhard 825,591
Apartment closure and stove fixture, combination, W. C. James 825,840
Auger bit, J. T. Parker 825,479
Automatic sprinkler, R. W. Gertz 825,453
Automobile climber, S. E. Burke 825,300
Automobile fender, J. D. Parke 825,478
Automobiles or the like vehicles, means for signaling on, E. & G. Barbaroux 825,694
Axle, steering, H. Lemp 825,329
Bag. See Feed bag.
Barette, E. B. Kingman 825,842
Barrel, C. D. Crandal 825,878
Basket making machine, E. L. Walker 825,566
Battery, C. W. Harper 825,882
Battery plate separator, secondary, L. W. Horton 825,837
Bearing, ball, E. Rivett 825,417, 825,418
Bearing, self-adjustable journal, crank, and axle, J. L. Williams 825,688
Bed, M. C. Rooney 825,681
Bed bottom, Besanger & Stewart 825,577
Bed, folding, P. Herbert 825,389
Beds, detachable hook for spring, Bullard & Scott 825,702
Bedstead, Kolgatzky & Cockerell 825,467
Belt replacer, W. Voikel, reissue 12,503
Belt tightener, W. G. Gaum 825,645
Binder, file, C. H. Morris 825,474
Binder frame, M. Forster 825,714
Binder, temporary, A. Faifer 825,447
Block machine, C. L. Scott 825,489
Block signal system, L. A. Hawkins 825,318
Boat, J. C. Nichol 825,340
Bobbin spring, G. M. Burgess 825,704
Boilers and furnaces, hinge and catch plate for, E. O. Haskins 825,722
Boots or shoes, attachment for golf or tennis, H. Sandeman 825,869
Boring machine, I. Young 825,791
Bottle, measured delivery, H. Raymond 825,350
Bottle, multiple compartment, H. Raymond 825,680
Bottle, non-refillable, Strupat & Brosius 825,360
Bottle, non-refillable, J. A. Pheiffer 825,413
Bottle, non-refillable, W. H. Young 825,502
Bottle, non-refillable, Kindig & Ferguson 825,543
Bottle, non-refillable, G. Evanovitch 825,814
Bottle stopper, G. Kirkegaard 825,603
Box fastener, E. F. Hulbert 825,463
Boxes, apparatus for operating covers of lock, J. W. Stephens 825,497
Bracelet, J. A. Fuller 825,644
Brake, C. W. Larson 825,327
Brake cylinder, tandem, L. H. Rogers 825,866
Brewing soy, T. Suzuki 825,500
Brick press, C. W. Reynolds 825,614
Brooder hover, H. H. Blackman 825,698
Brooders, mirror attachment for, H. H. Blackman 825,697
Broom, R. J. Ellis 825,590
Broom holder, J. D. Mack 825,332
Brush, shaving, E. A. Farron 825,448
Buckle, E. M. Hoagland 825,690
Buckle, W. D. Flynn 825,880
Buffer, S. M. Goldberg 825,717
Burglar and fire alarm, Goreline & Cramer 825,823
Butt hook, E. O'Brien 825,862
Button, collar, W. L. Fross 825,596
Cake cutter, E. Stumpf 825,775
Calculating machine, J. Vermehren 825,363
Calendar, D. T. Kendrick 825,394
Calipers, J. F. Haworth 825,648
Cane carrier feeder, G. D. Von Phul 825,778
Canning, apparatus for preparing fruit for, W. J. Latchford 825,667
Car brake, railway, P. P. Hatcher 825,724
Car coupling, P. D. Serrurier 825,767
Car draft rigging, I. A. Randel 825,349
Car end sill, S. Otis 825,675
Car fender, R. C. Layton 825,668
Car floor door operating mechanism, A. Campbell 825,580, 825,581
Car heater, electric, H. W. Buck 825,298
Car mover, L. Ehrlich 825,708
Car, railway, A. E. Ostrander 825,611
Car seat, Kilburn & McConnell 825,736
Car seat, F. K. Fassett 825,816
Car signal circuit, electric, W. Lintern 825,847
Carbureter, T. McCormick 825,336
Carbureter, gas engine, T. L. & T. J. Sturtevant 825,499
Carriage, child's folding, G. H. Pond 825,481
Carrier. See Game carrier.
Carton, Howe & Davidson 825,539
Cash register, E. S. Smith 825,493
Casket handle, E. R. Sargent 825,558
Castrating appliance, T. Heath 825,829
Cellulose of wood into fermentable sugar, converting, A. Classen 825,808
Cement manufacturing apparatus, C. Ellis 825,305
Cement structures waterproof, making, G. H. Lieban 825,846
Chain hook, G. Kernin 825,468
Check distributer, individual, J. T. Hicks 825,726
China kiln, J. C. Bins 825,651
Churn cover, A. D. Matterson 825,472
Clock, M. Wortmann 825,875
Clock, alarm, W. E. Porter 825,347
Clock, electric, R. L. Hight 825,833
Clutch, C. A. Fisher 825,384
Clutch mechanism, W. F. Jacobs 825,542
Clutch mechanism, friction, S. J. Davis 825,521
Clutch, safety winding, C. Johnson 825,323
Computing mechanism, J. A. Smith 825,494
Concrete casings, fittings for, F. A. Koetitz 825,604
Concrete construction for buildings, reinforced, C. P. Weeks 825,627
Concrete pile, reinforced, W. H. Healy 825,599
Concrete, reinforcing truss for, E. B. Jarvis 825,584
Concrete sectional conduit, reinforced, Keenan & Tobin 825,392
Condenser, C. L. Heisler 825,831
Condenser and making same, M. K. McGrath 825,405
Conduit coupling, W. W. Carpenter 825,583
Conduits, making hermetically sealed, A. S. Dixon 825,589
Confetto cannon, R. Kliemandt 825,843
Controller, H. E. White 825,367
Conveying system, E. B. Green 825,532
Cooky mold and cutter, F. A. Lohmann 825,849
Cooler and drier, A. W. French 825,595
Corn husking machine, green, H. Climer 825,516
Corner stay, H. H. Dewey 825,523
Corset, B. Kull 825,666
Cotton boiling, cleaning, and ginning machine, J. M. Gardner 825,818
Cotton compressing apparatus, W. M. Holmes 825,653
Cotton gin, W. F. Overmyer 825,341
Couch, reclining, J. Flindall 825,312
Coupling locks, device for operating, L. Parish 825,343
Crossover, removable, C. B. Ryan 825,382
Cultivator shield, H. Ver Heul 825,684
Cup holder, communion, C. P. Harris 825,316
Cupboard, folding, R. C. Russell 825,484
Current director, J. F. McElroy 825,859
Currents in spark coils, vibrating mechanism for interrupting, J. O. Heinze, Jr. 825,830
Curtain, J. C. Atkin 825,692
Curtain and shade holder, combined, E. F. Luetgenau 825,471
Curtain fixture, T. Lauther 825,737
Curtain pole, J. B. Kram 825,665
Curtain pole, A. J. Mapel 825,742
Curtain stretcher, J. Booth 825,375
Cushion, H. S. Hale 825,826
Damper regulator, C. P. Geritz 825,820
Dash foot and toe rail support, vehicle, P. E. Ebrens 825,640
Derailer, Linn & Patrick 825,740
Desk, J. A. Peterson 825,346
Desk, foldable, N. W. Selander 825,355
Display rack, J. H. Best 825,801
Distance instrument, W. Laska 825,605
Door, sliding, J. S. Schlosser 825,422
Doors, controlling switch for motor operated, J. W. Kellogg 825,393
Doors, lock setting gage for, A. Schrock 825,766
Draft appliance, B. E. Barney 825,505
Draft appliance, C. M. Thompson 825,776
Draft equalizer, F. Lindstrom 825,739
Drawer slide, J. Beaudet 825,695
Drawing in errors, device for correcting, H. D. Colman 825,585
Dredging and conveying apparatus, Knox & Ferris 825,545
Drier. See Grain drier.
Duck call, P. S. Olt 825,610
Dust guard, J. S. Patten 825,410, 825,411
Dust receptacle, C. D. Williams 825,630
Eccentric, E. J. Spencer 825,428
Electric furnace, F. T. Snyder 825,359
Electric furnace, J. F. Hammond 825,386
Electric machine, dynamo, P. Boucherot 825,877
Electric switch, C. F. Black 825,632
Electric switch, E. B. Jacobson 825,838
Elevator safety apparatus, A. V. A. McHarg 825,337
Elevator well door, W. J. Fletcher 825,449
Embroidering machines, shuttle driving mechanism for, Salzer & Walther 825,485
Emulsifier, C. A. Janson 825,732
Engine speed and spark regulating device, explosive, T. Van Tuyl 825,483
Engine vaporizer, hydrocarbon, C. F. Pearson 825,754
Engines, device for preventing back firing in explosive, G Holloway 825,835
Excavating and conveying system, E. B. Merry 825,743
Excavating apparatus, R. B. Page 825,553
Excavating machine, C. Kerr 825,658
Excavator, W. E. Magie 825,549
Exhibition hat case, H. Hefty 825,388
Eyeglass attachment, H. B. Wood 825,789
Eyeglass guard, W. G. Hahn 825,314
Eyeglass guard, L. A. Hines 825,650
Face shield, J. H. Ash 825,288
Fan, electric, A. F. Becker 825,576
Farm gate, C. H. Hunt 825,322
Feed bag for live stock, O. F. Garretson 825,452
Feeder, gravity boiler, W. A. Moffat 825,746
Fence and other post, E. M. Bunce 825,703
Fence fabric, wire, T. Litwiller 825,848
Fence tie, wire, R. Lake 825,398
Fender, W. S. E. Sevey 825,871
Fertilizer spreader, J. H. Jessen .. 825,654, 825,655
Fibrous materials, apparatus for separating oil or grease from, N. C. Lane 825,470
File, document, C. A. Phelps 825,414
Fire alarm system, Beane & Bennett 825,509
Fire escape, J. Dodds 825,524
Fire escape, portable, H. H. Barsalon 825,506
Fire extinguisher, H. E. Safford 825,868
Fireproof door, E. B. Tonnsen 825,777
Fish hook, C. M. Curtis 825,639
Floor, T. Cantwell 825,582
Fluid meter, F. Lambert 825,399
Fly trap, F. Klousnitzer 825,660
Folding and other machines, frame construction for, C. A. Sturtevant 825,429
Foot warmer, C. Schaefer 825,763
Fruit syruping machine, L. F. Graham 825,598
Funnel, G. N. Haskell 825,317
Furnace charging apparatus, blast, Ford & Parks 825,643

Furnaces, automatic regulating means for, F. E. Roach 825,615
Furnaces, rake construction for McDougall, G. S. Crouse 825,519
Furniture, C. E. Mead 825,854
Furniture, combination or convertible article of, J. W. Hughes 825,540
Fuse, G. Deisenhofer 825,879
Fuse box, P. C. Morganthaler 825,333
Game apparatus, card, W. J. Connell 825,809
Game carrier, J. M. Paul 825,753
Garment fastening, H. M. Neidig 825,551
Garment fitting table, C. W. Walling 825,782
Garment hook, T. J. Browning 825,701
Garment supporter, Kennelly & Donch 825,395
Gas generator, acetylene, W. H. White 825,368
Gas generator, acetylene, D. W. Haseltine 825,535
Gas heater and evaporator, P. S. Murta 825,607
Gas, making self-igniters for, H. Schimmel 825,765
Gas, means for automatically lighting, H. Schimmel 825,764
Gas meter, wet, J. O. Jones 825,324
Gas regulator, H. C. Grimes 825,718
Gasolene flame projector, A. H. Stow 825,619
Gate, A. Y. Fry 825,716
Gear cutting machine, E. J. Flather 825,311
Gearing, J. Wilkinson 825,438
Gearing, hand and power controlled, B. M. W. Hanson 825,647
Generator. See Gas generator.
Gins, roller for roller, T. H. Pearse 825,344
Glass blowing machine, G. H. Schmitt 825,423
Glass grinding machine, Goehring & Troche 825,454
Glass houses, flattening wheel for, S. F. Field 825,310
Glove, A. & A. Bloc 825,510
Gloves, manufacture of impregnated, C. Wellbier 825,435
Grading and ditching machine, S. E. Freeman 825,45
Grain, conditioning, Caldwell & Barr 825,378
Grain, developing the fermentable products from, A. F. Kniesche 825,662
Grain drier, J. Nash 825,407
Grain grader, N. L. Hill 825,396
Gramophone, G. Hensch 825,725
Grate and fixtures therefor, J. Ferracioli 825,713
Grease separator, W. J. Baldwin 825,573
Griddle greaser, E. J. Lightbown 825,400
Grinding machine attachment, G. E. Buck. 825,803
Grinding mill, M. F. Abbe 825,285
Grinding wheel, G. Hart 825,460
Ground detector and cut out, E. F. W. Alexanderson 825,286
Guns, single trigger for double, J. J. Murphy 825,550
Hame, harness, J. R. Hughes 825,730
Hammer, J. H. Smith 825,560
Hammock, W. S. Bowie 825,700
Hanger, I. Stanley 825,773
Harrow, H. C. Simons 825,872
Hawser, C. W. H. Muhlstephan, Jr. 825,748
Hay or straw in mows, device for unloading and distributing, W. P. Allen 825,571
Heel cushion for shoes, spring, Bryne & Young 825,515
Hinge, lock, C. H. Swan 825,430
Hoe, W. A. Sparks 825,772
Hook and eye, J. A. Werner 825,568
Horseshoe, J. B. White 825,437
Hydrocarbon burner, J. F. Barker 825,290
Hydrocarbon furnace, Vraalstad & Doyle 825,779
Hydropneumatic press, E. D. Coddington 825,301
Igniter, electric, H. M. Kolb 825,664
Implement, combination, G. A. Hasseler 825,461
Inductive bond, Howard & Rice 825,538
Inkstand, F. A. Alteneder 825,691
Insecticide, W. Williams 825,787
Insulator, M. F. Baker 825,795
Ironing machine, W. E. Andree 825,441
Ironing table, W. G. Woodmansee 825,440
Journal box and bearing, G. Winkler 825,689
Knitting machine latch closer, H. Pulster. 825,679
Lamp fixture, electric, R. B. Benjamin 825,445
Lamp fixture, electrical, N. Weeks 825,434
Lamp holder, electric, R. B. Benjamin, 825,443, 825,444
Land smoother, M. B. Gooing 825,646
Latch, gate, C. O. Young 825,690
Lawn sprinkler, Barkelew & Grigsby 825,575
Leaching solutions, treating acid, P. F. Cowing 825,302
Level, J. L. Russell 825,760
Level, spirit, E. G. Hewitt 825,320
Library and desk, revolving, J. E. Wamble 825,783
Light extinguisher, time, Sewell & Trussel 825,491
Limbs, suspensory controlling device for artificial, T. W. Klopp 825,659
Liquid distributer, L. Perotti 825,345
Liquid impelling device, E. P. Holly 825,652
Liquid separator, centrifugal, H. C. Pawley 825,412
Liquid separator, centrifugal, W. C. Hartmann 825,721
Liquids from solids, apparatus for separating, W. H. Lomas 825,331
Litter carrier, A. F. Jansen 825,465
Load indicator, H. James 825,839
Locket, E. A. Phillips 825,676
Loom for weaving sheer or Swiss fabrics, E. H. Ballou 825,504
Loom picker check, M. F. Field 825,309
Loop, handle, Townsend & Johnson 825,563
Lubricating apparatus, W. W. Nugent 825,609
Lubricator, C. Comstock 825,586
Magnet device, polarized, M. K. McGrath 825,466
Mail box, W. H. Zylstra 825,503
Mail box, speaking tube, etc., combination, W. J. McWade 825,339
Mail carrying cabinet, H. D. Hackney 825,456
Mail marking machines, separating mechanism for, H. Osborn 825,476
Match box and oil can, combined, E. J. Beever 825,372
Measuring implement, H. S. Milks 825,606
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Mile meter, H. Tyler 825,432
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Mine hoist, A. B. Paige 825,477
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A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

DESIGNS FOR BATTLESHIPS.—The Navy Department invites the attention of competent naval constructors in the United States to the opportunity afforded by the Act of Congress (Public No. 336) to submit plans and specifications for a battleship. Preliminary plans will be received under seal on November 1, 1906, which preliminary plans, with the attendant specifications, shall show the displacement, draft and dimensions of the battleship proposed and the speed and estimated cost, and likewise within what time completed plans and specifications for the construction of such vessel will be furnished, if desired by the Department, and finally, what amount will be deemed by the said constructor just and equitable compensation for the said preliminary and the said completed plans, should the same or either of the same be paid for by the Department in accordance with the terms of the statute aforesaid. A copy of the Departmental circular on the subject will be sent on request addressed to the Navy Department, Washington, D. C.

CHARLES J. BONAPARTE, Secretary of the Navy.

PROPOSALS.

PROPOSALS will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 o'clock A. M., August 7, 1906, and publicly opened immediately thereafter, for the construction of buildings consisting of operating house, power house, oil house, privy, etc., and erection of masts at the wireless telegraph station to be located at Fire Island Beach, Lighthouse Reservation, Long Island, N. Y. Applications for proposals should refer to Schedule 54. Copies of drawings can be obtained upon application to the equipment officer, navy yard, New York. Blank proposals will be furnished upon application to the navy pay office, New York, N. Y., or to the Bureau.

H. T. B. HARRIS, Paymaster-General, U. S. N. 7-13-06.

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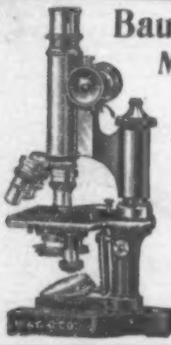

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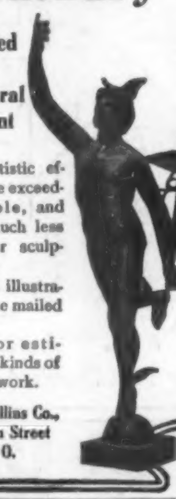

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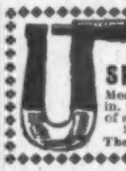

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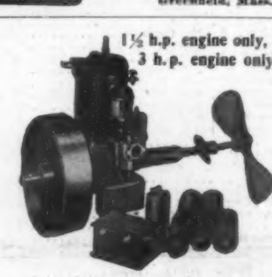

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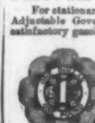

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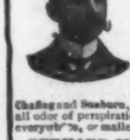

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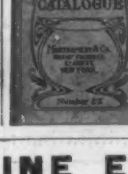

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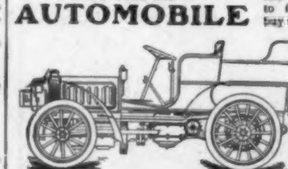

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